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[H.N.S.C. No. 104–16]

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(H.N.S.C. No. 104-16): New Attack S...

NEW ATTACK SUBMARINE

HEARING

BEFORE THE

MILITARY PROCUREMENT SUBCOMMITTEE

OF THE

COMMITTEE ON NATIONAL SECURITY
HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTH CONGRESS

FIRST SESSION

HEARING HELD
SEPTEMBER 7, 1995

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ADVANCED TECHNOLOGY TO THE NEW ATTACK SUBMARINE

House of Representatives,
Committee on National Security,
Military Procurement Subcommittee,
Washington, DC, Thursday, September 7, 1995.

The subcommittee met, pursuant to call, at 10 a.m. in room 2118, Rayburn House Office Building, Hon. Duncan Hunter (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. DUNCAN HUNTER, A REPRESENTATIVE FROM CALIFORNIA, CHAIRMAN, MILITARY PROCUREMENT SUBCOMMITTEE

Mr. Hunter. The subcommittee will come to order. As we prepare to begin the conference on the fiscal year 1996 DOD authorization bill this afternoon, one of the most contentious issues to be resolved will be the issue of nuclear attack submarines. As members may recall from our earlier hearing in March, the Navy's No. 1 priority in its fiscal year 1996 procurement budget request are submarines, the third and final *Seawolf,* SSN–23, and its follow-on, the new attack submarine, the so-called NAS. The Navy requested $1.5 billion to complete the SSN–23 and $705 million for advanced procurement of the NAS.

The administration's Bottom-Up Review plan was to construct both the *Seawolf* and the entire NAS class of 30 submarines at Electric Boat, the EB Division of General Dynamics in Groton, CT.

The committee did not authorize the SSN–23, which the Navy has admitted for the last 2 years is not required for operational purposes but rather is needed as an industrial bridge to keep EB in business until 1998 when the NAS is to begin serial production.

Furthermore, the committee rejected the notion of having one shipyard produce the next-generation submarine at the expense of having the skills to build such submarines atrophy at the Nation's other nuclear-capable shipyard, Newport News Shipbuilding, known as NNS.

The committee focused its attention on the *Seawolf* not on the *Seawolf*, but on the NAS. Its objectives were, one, to avoid production of a scaled-down, less-capable version of the *Seawolf* in recognition of the fact that despite an economy experiencing great difficulty, Russia's defense policy continues to emphasize submarine technology, and the fact that the Russians currently operate the quietest submarine in the world; and, two, to avoid the prospects of an unaffordable next-generation submarine by introducing competition into its acquisition.

Thus, the committee decided that a national priority program was needed to achieve a next-generation submarine design which represents an improvement over the NAS design and that a key feature of this program should be technological competition between Electric Boat and Newport News.

However, realizing that competition could not be introduced in the short term, the committee chose to provide EB with $850 million to demonstrate such innovation on the design of two outfitted submarine hull sections, the first of which would be incorporated on the second *Seawolf* currently under construction at EB and the second of which would be installed on a one-of-a-kind NAS which would begin construction at EB as scheduled in 1998. These hull sections might be optimized for Special Operations Forces, mine warfare, land attack missiles, other missions, or some combination as determined by the Navy.

The committee also chose to provide NNS with an analogous opportunity to demonstrate its talents as an innovative submarine designer and builder by authorizing $150 million to be used as initial funding for an effort at NNS to design, develop, and build prototype versions of submarine components which have the potential for achieving substantial improvement in capability and affordability over the current NAS design.

The committee plan envisions that these innovative efforts by both shipyards would provide the basis for either a follow-on submarine that could be completed for serial production in 1999 or production of the first of a series of operational prototype submarines, each of which would incorporate accelerated technology improvements, leading to serial production of a next-generation submarine several years hence. The United States built several one-of-a-kind submarines from the 1950's through the 1970's to rapidly test new technologies and made rapid strides in the process. Since then, however, the United States has built only minimal-risk, series-production submarines rather than path-breaking prototypes.

Recognizing that the other body appears comfortable with and is poised to endorse the Navy's proposal for serial production of the current NAS design, the purpose of today's hearing is to elicit expert opinion on this decision versus the committee's proposal to build operational prototypes rather than proceeding to produce a platform which may not be a true next-generation submarine capable of preserving or regaining U.S. undersea superiority.

We have some extraordinary witnesses with us this morning, and we have tried to retrieve and have successfully retrieved for this hearing two of the members of Les Aspin's blue ribbon panel, Dr. John Foster, Jr., and Dr. Lowell Wood. We have with us also Mr. Norman Polmar, a world-recognized authority on maritime issues and on submarines and well-known author and prolific writer on the issue, and Ron O'Rourke, who is our resident submarine expert from CRS is with us this morning.

Ron, we appreciate this endurance, this great marathon that you have been engaged in on the submarine issue this year with this committee. You have been a very valuable asset to the Congress.

So we have some witnesses this morning who will comment on the Navy's new attack submarine program. We have with us also

Rear Adm. Dennis Jones and Rear Adm. Robert Frick to describe the Navy's position with respect to the new attack submarine, and we have had some interesting sessions on airlift, on sealift, on submarines, in which this committee puts the Navy at the panel with other experts, from the Air Force in some cases; and we have had some good dialog and some good back and forth. I think it has been a little departure from the way hearings are usually conducted, but I think it has resulted in good interchanges. Let me give a little background on the path that we have taken to reach this point.

We also have another gentleman—kind of a legend on the Hill, who was here when I arrived in Washington in 1980; that is Mr. Tony Battista, who is a former professional staff member on the House Armed Services Committee.

And, Tony, it is awfully nice to have you with us. You have been a tremendous asset to this committee and to this country for many, many years, and it is nice to have you with us and to have your beautiful wife Doris attending here, too. I am sure this will be very entertaining for her to hear you testify today. Thank you for coming back.

Mr. BATTISTA. Thank you. I think everything I say she is entertained by.

Mr. HUNTER. That is what I understand.

Doris, thanks for coming today.

But in 1988 our former House Armed Services Committee chairman, Les Aspin, commissioned a blue ribbon panel of specialists in submarine development and antisubmarine warfare to prepare a report for the committee outlining whether or not the then Soviet Union's capability in these areas might be outstripping those of the United States. The members of that panel included Secretary of Defense—now Secretary of Defense Bill Perry; Under Secretary of Defense for Acquisition and Technology, Paul Kaminski, Dr. John Foster, and Dr. Lowell Wood, who are with us today. Mr. Battista was the staff director of the R&D Subcommittee of the House Armed Services Committee at the time, and he oversaw the creation of this panel for Chairman Aspin, so it is important, I think, to have Tony here today, because he has some of the corporate memory of the path that we followed at that point to get to the present situation.

I wanted to mention also that Adm. Robert Frick is with us today to testify as the program executive officer for submarines, Office of the Assistant Secretary of the Navy for R,D&A [Research, Development and Acquisition]; and Admiral Jones is the Director of the Submarine Warfare Division, Office of the Chief of Naval Operations.

So, gentlemen, thank you for contributing and being with us this morning.

In the interest of time, your written statements will be accepted for the record, and I would like to ask each of you to take about 5 minutes to summarize those statements. And let me just say, especially for folks who don't know Dr. Foster, don't know Lowell Wood, Lowell has been on many panels, and many issues have been important to this committee, especially in missile defense work and many other areas. He has worked on important programs for the Navy. He is considered to be the father of Brilliant Pebbles and the father of the x-ray laser. And, Lowell, we are going to get a winner soon, and I assure you, believe me, it will happen.

Dr. John Foster is considered by many folks in the last 10 to 20 years to be one of the most valuable technical minds in defense for this country. He is probably the best credentialed scientist in the United States today, in my estimation, in weapons programs, former head of research and engineering for two Presidents, Democrat and Republican, chairman of—former chairman of the Defense Science Board, longest-serving member for the President's foreign intelligence advisory board and just got finished chairing the Summer Studies Program for the Defense Science Board, so he came off of that task and immediately launched into the submarine issue.

So, Dr. Foster, thank you for taking your time to be with us.

So what I would like to do is—Ike, let me recognize you for whatever comments you would like to make and then we will turn the floor over to our witnesses.

The gentleman from Missouri.

Mr. SKELTON. Thank you. First, let me tell you, Mr. Chairman, I am glad you are holding this hearing. I think it is very, very important that we delve into it.

For over 8 months this panel has been struggling to determine the direction of our Navy's submarine capability. I, for one, am deeply distressed by the future of our Navy and, of course, of our military as a whole. As I have said, this year Congress will determine whether the United States remains a first-rate military power by what we do in this committee. I am encouraged by many of the recent recommendations from our committee, but I still remain concerned.

Mr. Chairman, I am worried about the Russian Navy's continued emphasis on submarines. Not only have the Russian designs improved, but production has kept steady. My sources tell me, by the year 2000, the Russian submarine force may significantly outnumber ours. Of course, this concerns me. It may be time to initiate robust submarine production just to maintain parity on the sea. It may be time to enter discussion about this technology or that technology, do the best we can and produce—begin producing boats, for we know when the time comes, our Nation's greatest advantage has been, and always will be, our people, particularly the people of the sea. I remain confident in the ability of our naval personnel to maintain our superiority.

Before us today is a very distinguished panel of witnesses with expertise in submarine capability. I look forward to these gentlemen not only to shed light on our strategic position in the world, but to shed light on our apparent inability to make a decision with regard to submarine technology. I look forward to the testimony.

In particular, I welcome our friend from yesteryear, Tony Battista, who gave us thoughts, advice, those many days ago. We appreciate you being with us. We look forward to hearing you, and we also look forward to hearing what our gentlemen—our folks from the Navy have to say, because they are the ones who, after all, have to sail these ships and make them do what they are supposed to do.

Thank you.

Mr. HUNTER. I thank the gentleman.

We were going to start off with Dr. Foster; but Tony, since you kind of have the corporate memory on the blue ribbon panel that Chairman Aspin put into place, why don't you lead off and give us a snapshot of what you saw at that time, what the committee saw at that time, and how the panel developed and where you think we are.

STATEMENT OF TONY BATTISTA, PRIVATE CONSULTANT AND FORMER PROFESSIONAL STAFF MEMBER, HOUSE COMMITTEE ON ARMED SERVICES

Mr. BATTISTA. All right. Thank you, Mr. Chairman, and thank you for your invitation asking me to share some of these views on a subject that, I think, is probably one of the three highest priority items in this country today. I put the survivability of our submarine force in the top three.

I would like to preface my remarks by recalling the days when Mr. Stump, who also served on the Permanent Select Committee on Intelligence, was instrumental in taking some of the intelligence estimates and supporting that committee position. It was Mr. Stump in concert with Congressman Cheney, later Secretary Cheney, who, I think, provided the main impetus behind the antisubmarine warfare [ASW] effort that led to the Aspin panel, and I think we owe a great deal to Mr. Stump.

Let me get right to the point. I do have a slight difference of opinion with the Navy relative to the threat. I consider the Navy position to be somewhat conservative.

I think Russian submarine and antisubmarine warfare technology is even more advanced than the intelligence community would have you believe. I think the quietest, both acoustically and nonacoustically operational—and I emphasize that word "operational"—attack submarine today doesn't belong to the United States, it belongs to the Russians. I think what you are going to see in the next-generation Russian attack submarine is going to pale the present Akula and represent the Russians' most notable advance in the last decade. I think in terms of the threat, while the Russian intent has softened and changed, the capability of their submarines is not only there, but it is better and getting better.

We are not spending enough on submarine and antisubmarine warfare technology. When you consider, Mr. Chairman, the carrier battle group, you are talking about a $4.5 billion carrier, you are talking about 90 aircraft on that carrier, you are talking about cruisers, you are talking about destroyers; you have a several hundred billion dollar investment in that carrier battle group, and the critical element to the survivability of that carrier battle group is the submarine with its stealth characteristics. So this is an area where, I think, it is very shortsighted and very poor economics to say that, well, we are not going to spend as much as we should, or we have got to cut the submarine budget as we do other areas. It is false economy. We are paying too much for our submarines, and in terms of the threat, we are getting a very poor return on investment, and last, my observation is that the entire submarine and the antisubmarine program should be restructured—in part, as proposed by what you have done on this committee—and should be a high priority national program. I do think we ought to assign national priority status to this whole area of submarines.

Let me put my observations in the context of what you have done this year and what the Senate has done in House bill H.R. 1530 and the Senate amendment S. 1026. Your report puts the emphasis on submarine capability, the needs of the fleet with a secondary concern over the industrial base.

In contrast—and I am sure they didn't intend it this way, but in my reading of the Senate report, the emphasis seems to be on the industrial base, and the fleet comes across to me as somewhat of an afterthought; and I do think that we have got to get our priorities straight. The industrial base should be the benefactor of what we do for the fleet, not the converse.

I think this body should be commended, you, Mr. Chairman, and especially the subcommittee, on what you have done to restructure our Nation's submarine program. You recognize that the new attack submarine, as it is presently proposed, may not be good enough; and you initiated a program that is going to give us several prototypes from which we can choose, one that I believe—an approach that I believe will keep us ahead of the Russians.

The Honorable Mendel Rivers from this committee had a favorite expression: There ain't no education from the second kick of a mule. You knew 8 years ago that the SSN–21 was questionable in terms of its capability. I have attached in my statement a copy of a Washington Post article—it was on the eve of my retirement—where I question the ability of the 21, the *Seawolf* class; and at that time, remember there was a heated debate before the House Sea Power Subcommittee that was chaired by Mr. Bennett of Florida at that time, and I recommended terminating the SSN–21 program; and I thought that the committee had done a tremendous service to the country by coming up with a compromise position that said, we will fund the *Seawolf* provided you get started on a new attack submarine.

It is rather interesting that the Navy really objected strongly to that add-on back then, and here we are today talking about a new attack submarine, be it theirs or be it the program that you have structured. What you have to ask yourself is what was wrong with the 21, why didn't we build the full complement of 30 submarines or 32, I believe the number was; and if the answer is, it costs too much money, then there was something inherently wrong in the approach that we took that provided us with something that we couldn't afford.

In the House bill, as I said, you put the U.S. submarine program in proper perspective, and I think that this point about paying too much for submarines is a valid issue. I don't place the blame on the industry for this. If you have ever been to Electric Boat, if you have ever been in Newport News, those people are real button poppers in terms of being proud of their product. They are really dedicated. They are an honest, good group of people, but they only deliver what the customer asks for.

I blame the Navy, I blame the Department of Defense; in fact, I blame the Congress for the situation that I believe we are in today, the poor situation that we are in today. I blame the Navy for not proposing an adequate program. I call it a flawed program.

I am not talking about *Seawolf*; I am talking about the entire program. I view submarines and antisubmarine warfare as one broad category, and they are dependent variables.

When you are cutting back and not proposing the right program because of funding constraints, that in itself is inherently flawed. I blame the Department of Defense for not serving as an effective board of directors and realizing the importance of submarines to our force structure; and last, I blame the Congress for not exercising the proper oversight and providing authorization and appropriation for a program that would allow the Russians to forge ahead of us.

In retrospect, that is the only conclusion you can come up to, they have forged ahead of us in some areas; and I think in the world of submarines and antisubmarine warfare there is not an area that I can think of that we should be second in. Until this year, I believe you have legislated mediocrity; to be perfectly blunt about it, there was more concern about the industrial base and the urge to build something than there was over the future of the fleet. I think you have changed that.

I will give you an aside, too. I think you should do something about the current procurement policies that we have. We continue to spend $10 to save $1. We are strangling the industrial base, if anything. I think you have got to relook that; and everybody says, well, Bill Perry is looking at the problem, but the progress is slow. The progress doesn't have to be slow. My God, you can legislate in any given year procurement reform that is going to put trust back in the system and let people build things and be looking ahead rather than constantly looking over their shoulders.

Now let me give you a few points that you might want to consider on the cost of submarines. In World War II, we paid about $80 million for an aircraft carrier, a submarine was about $2 million, a ratio of about 35 to 1. Today that aircraft carrier costs $4.5 billion; a *Seawolf* submarine—and I am being conservative, and I am sure the Navy will disagree—is about $3 billion. I have to ask, why does a 9,000-ton nuclear-powered submarine cost nearly as much as a 96,000-ton nuclear-powered aircraft carrier? Everybody else in the world seems to be on the $200 to $300 million, $400 million line relative to cost, even though they are smaller submarines, 1,800 to 3,000 ton displacement.

I have got to ask you, Mr. Chairman and members of the subcommittee, to try to rationalize that there is $2.6, $2.8 billion difference between a diesel-powered submarine and a *Seawolf*. Granted, ours are better, but I can't say they are that much better in terms of cost.

There are a number of things we can do, and it is in my statement. I don't want to read everything here, but there are a number of things we can do to enact cost savings in submarines that is not going to compromise capability.

I can remember when the subex, which is now the busy two, the combat control system on the *Seawolf* had a $908 million overrun in 1 year. You know, that is 900 percent more than the Australians are paying for their complete combat system for the *Collins* class destroyers. We are not taking advantage of the fact that you can by a Pentium 90 megahertz processor today for $3,000, and two months from now have it cost $2,000. Electronics in the commercial world is going down, yet the price of electronics for submarines is going up.

So I will conclude by saying that we are paying too much for our submarines. We are not capitalizing on commercial advances, and until the House bill, we have supported an industrial base that, in fact, is the very reason why we can't build a force structure that we need. I mean, we have got to get the cost of these things down.

Let me talk about the 23 for just a moment, and whether you support the 23 or you oppose the 23, let's put it in its proper perspective. You don't have $1.5 billion to go on the 23. I use historical algorithm. The cost of ownership of a submarine equals the cost of the acquisition. You pay $3 billion for a *Seawolf*, you are going to pay $3 billion over its life cycle to maintain it. So you don't have $1.5 billion to go; you have $4.5 billion to go if you are going to support the *Seawolf*. If you are going to go with the Senate position on that, please do so because the fleet needs it, not because of the specious argument that we have got to preserve the industrial base.

I look at this little brochure, for example, that is put out, and it says, the third *Seawolf* provides unmatched capability and the only cost-effective bridge to the new attack submarine. It goes on to say that it retains the indispensable submarine design, engineering, and industrial skills required for the future. To me, that is nonsense. The submarine is already designed. How are we preserving a design industrial base by building a submarine that has already been designed? So if you change your position on that, do so because you think the fleet needs it.

There is absolutely no correlation between the industrial base and the *Seawolf*. There are other less costly approaches to it.

Now, let me hit the most important aspect—and I will summarize with this—the new attack submarine. Your bill is a radical departure from the business-as-usual approach. I don't think we have got to rush to a 1998 submarine. I think we have got about, no more than about 3 years of breathing time. I would be very concerned if we let it go beyond that, but we are not going to get a submarine for $1.5 billion, as some people forecast in this new attack submarine. Remember, the *Seawolf* was designed to cost $1.3 billion, and in 1988 I told you at the time that it was going to cost $2.8 billion. That was independent of whether we built 25 or 30 or 15. I told you it was $2.8 billion, that was the minimum price, and it is in your transcripts; you can go back and read that. And we are starting out with $1.5 billion on the new attack sub, and I am willing to bet that it will wind up costing as much as the *Seawolf*.

So the question should be, if we are going to take this approach, Why don't we just continue on and build the other 29 *Seawolfs*? That would make sense. But the approach you have taken, calling for competitive options, is an extremely good one.

Mr. Chairman, we should not restrict the design of submarines to one yard. I think Newport News still has an awful lot to offer, and again, it is false economy to say that we can go with one in an area that is so critical to the survivability of our fleet.

Let me just summarize by saying that I think we have got a new world order today, and our strategic triad that once consisted of bombers, submarines, and intercontinental ballistic missiles has changed. Today, I view the three legs of the triad as being national defense, the solution to our economic problems, the reduction of the deficit, et cetera, and then the solution to our domestic problems; and there is more synergy among those three legs of the triad than there was in the old version of the triad.

I think the new submarine this country builds is going to be with us beyond the year 2025. You have made this year the epoch for a completely new way of building submarines. I hope your position prevails because 20 years from now, the fleet is going to be the beneficiary of this insurance policy that you wrote this year and it will be the Russians who are trying to catch up again and, I would speculate, unsuccessfully. So you have really gotten on to the right approach, and I hope your position prevails.

Thank you.

Mr. HUNTER. Tony, thank you. It is awfully nice to have you before the committee again. We appreciate you so much and your continued service to the country.

[The prepared statement of Mr. Battista follows:]

STATEMENT OF A. R. BATTISTA
BEFORE THE HOUSE NATIONAL SECURITY COMMITTEE

September 7, 1995

Mr. Chairman, I thank you for your invitation asking me to share my views on this most important subject of submarine technology with you and the Members of the Procurement Subcommittee.

I'll get right to the point with my personal observations:

- Russian submarine and anti-submarine warfare (ASW) technology is even more advanced than the assessment provided by U.S. intelligence sources.
- The quietest - both acoustically and non acoustically - operational attack submarine in the world today is owned by the Russians - the Akula.
- The next generation Russian attack submarine will pale the Akula and represent the Russians' most notable advance in the last decade.
- In terms of the threat, while Russian intent has softened and changed, the capability in submarines not only remains but is getting better.
- The U.S. is not spending enough on submarine and ASW technology.

- The U.S. is paying too much for its submarines and in terms of the threat is getting a very poor return on investment.

- The entire U.S. submarine and ASW program should be restructured - in part as proposed by the House National Security Committee - and should be a high priority national program.

I would like to put my last observation in the context of what the Congress is proposing in House bill H.R.1530 and the Senate amendment S.1026. The emphasis in the House report is on submarine capability, the needs of the fleet with a secondary concern over the industrial base problem. In contrast, the theme of the Senate report focuses more on the industrial base with fleet requirements and submarine capability being secondary or, in my mind, an afterthought.

Mr. Chairman, you, this subcommittee, the Chairman of the full committee and in fact, this entire body should be commended on the bold action you have taken to restructure our nation's submarine program. You recognized that the New Attack Submarine (NAS), as presently proposed, may not be good enough and you initiated a program that, if properly executed, will provide an NAS that will lead rather than follow its Russian counterpart.

A former Chairman of this committee, the Hon. Mendel Rivers, had a favorite expression "there ain't no education from the second kick of the mule". You knew eight years ago that the SSN-21 might not be good enough. I have attached a Washington Post article of February 9, 1988 offering my views on this subject.

Departing Hill Specialist Attacks Navy's New Sub

Soviet Progress, U.S. Budget Pressure Cited

By George C. Wilson
Washington Post Staff Writer

A senior House Armed Services Committee staff aide, in a parting salvo before leaving his job, declared yesterday that the Navy should scuttle its planned Seawolf attack submarine to build a better boat, and sink its two aircraft carriers on the drawing board to hold down the Defense Department budget.

Anthony R. Battista, who, for the last 14 years has often infuriated generals and admirals by poking holes in their pet projects as staff director of the research and development subcommittee, said on the eve of leaving his post next month to become a private consultant that the Pentagon must take drastic actions now to keep its budget from ballooning out of control in the 1990s.

> *"We can fix the surface Navy. The real threat is undersea."*
>
> —Anthony R. Battista

If Defense Secretary Frank C. Carlucci canceled some big weapons programs and got really tough on research projects, Battista said, he would not have to take thousands of soldiers, sailors and airmen off the payroll to accommodate the cuts Congress is almost certain to make in the next five fiscal years, just as it has for the last two.

The SSN21 Seawolf submarine now entering development is not good enough to combat the undersea threat posed by rapid Soviet advances, Battista said. The Soviet Akula attack submarine "is the best submarine in the world today," he said. Last year Battista took the lead in persuading the House research subcommittee to cancel the Seawolf and strive for a better submarine. Congress reversed that decision and funded the Seawolf as well as providing $100 million to work on a more advanced attack sub.

The Navy wants $1.7 billion in the fiscal 1989 budget to buy the first Seawolf. Carlucci is reviewing that and other plans in his effort to restructure his budget to fit the new realities of a Congress determined to flatten the Defense Department's spending rather than increase it yearly as President Reagan had requested.

Congress last year approved a $3.3 billion nuclear-powered aircraft carrier, due in 1997, and a $3.6 billion carrier, for service in 1999.

"We can fix the surface Navy," Battista said in making his case against the two new carriers. "The real threat is undersea," he said, meaning that developing better submarines and combatting Soviet ones should receive top priority in the era of tighter budgets.

Service leaders contend the Navy is confronted with many carriers growing old simultaneously and must build new ones to have 15 capable of being deployed to distant locations. They also insist that the Seawolf will be the best attack submarine.

In other remarks made during a luncheon with a group of reporters, Battista discussed:

- Procurement. The elaborate rules that Congress and the Pentagon have imposed on defense contractors have cluttered the process to the point that the nation is now "spending $10 to save $1." A better approach would have been to make the punishment for shoddy work and outright fraud so severe that few contractors would have dared take the risk.
- Air Force Maverick air-to-ground missile. Not worth continuing to buy.
- Research duplication. The Pentagon has been so lax in winnowing out duplicative projects that the military services currently are developing six different radio programs "all to communicate with another airplane.
- Navy shipbuilding. The fragility of the USS Stark, severely damaged by a French Exocet missile in a Persian Gulf attack last year in which 37 sailors died, and problems with the new Arleigh Burke destroyer stem in part from "incompetence" in designing ships. "We're running out of naval architects."

Battista plans to leave his subcommittee staff post on Feb. 15. He will be succeeded by Carl T. Bayer, who another subcommittee staff aide, and a new staff member, Thomas Hahn, who formerly worked there before going into private business.

You may recall a rather heated debate before Mr. Bennett's Sea Power Subcommittee in 1987 when I made this charge. You supported the recommendation to allow the SSN-21 program to go forward in conjunction with the development of an NAS for which you provided $100 million additional authorization. The Navy objected to this add-on. In retrospect, the Congress never got what it requested.

The House bill puts the U.S. submarine program in proper perspective. Your bill makes the industrial base the benefactor of what we do for the fleet rather than the converse. I believe that our industrial base is in a rut. Through years of doing business the same old way, the submarine industry has not capitalized on advances in commercial technology. Consequently, we are paying too damn much for today's submarines. I don't place blame on the industry for this. The folks at EB and Newport News are hard working, honest and proud. They deliver only what the customer asks. Rather the blame is on the Navy, the Department of Defense and indeed, the Congress. The blame is on the Navy for putting its head in the sand and ignoring technological advance in favor of acquisition. Further, the Navy continuously discounted Soviet advances.

I blame the Department of Defense for not serving as an effective Board of Directors and allowing the Navy to proceed with a flawed program.

I blame the Congress for not exercising the proper oversight and providing authorization and appropriation for a program that would allow the Russians to forge ahead of us.

Until this year, you legislated mediocrity. To be perfectly blunt about it, there was more concern over the industrial base and the urge to "build something" than there was over the future of the fleet.

Let me give you a few points to consider on the cost of submarines:

(1) In World War II an aircraft carrier cost about $80 million, a submarine e.g. the Balao class about $2.3 million - a ratio of about 35 to 1.

(2) Today an aircraft carrier costs about $4.5 billion, a Seawolf submarine about $3 billion (I'm being conservative) - a ratio of about 1.5 to 1. Do you wonder why a nine thousand ton nuclear powered submarine should cost nearly as much as a ninety-six thousand ton nuclear powered aircraft carrier?

(3) The Germans, Swedes, British, Australians and others all build submarines in the 1800-3000 ton displacement range with diesel power at a cost of $200 - 400 million each. These costs follow projections from World War II. Despite our larger submarines with nuclear power, can you rationalize a 2.6 to 2.8 billion dollar differential?

(4) Nuclear propulsion results in about 70% waste heat. We dump this waste heat overboard and still provide discrete heaters on submarines. Perhaps the cost of heaters is not that high but has anyone wondered why we don't use some of this waste heat to eliminate the heaters?

(5) The Australians contracted a U.S. firm to build the combat control system for under $100 million including the "wet end" for its Collins class submarines. Although the Navy would argue, I contend that the Seawolf combat control system costs over $500 million. Another interesting point is that the cost overrun for the Seawolf combat control system was $900 million in a single year - or 900% more than the cost of the Australians' system.

A few months ago, I purchased a personal computer with a Pentium 90 mhz capability for $3,200.00. Within 60 days, the price dropped to $2,200.00 due to the announcement of the 125 mhz capability. While the price of commercial electronics drops, the price of submarine electronics keeps rising.

I could go on but, in my view, we are paying far too much for submarines, are not capitalizing on commercial advances and until the House bill, we have supported an industrial base that, as structured, is the very reason why we cannot afford to build the requisite number of submarines.

Mr. Chairman, I would like to address the issue of the SSN-23. Of course the fleet could use the SSN-23 if it were authorized and appropriated, but the main issue is whether the Navy or the country can afford it. Let's put to rest the correlation between the industrial base and the 23. Forging ahead with the SSN-23 does nothing for the submarine design industrial base - the SSN-23 is already designed. The second industrial base issue affects the blue collar work force. This problem could be solved by assigning some SSN-688 overhauls to EB. I cannot understand why we are cutting up nuclear powered submarines at less than half the remaining service life. If you are going to reconsider your SSN-23 position, please do so on the basis of affordablity and fleet requirements and not on the specious industrial base argument. There are other and less costly bridges between the SSN-22 and the NAS.

The SSN-23, regardless of your position, does not represent a $1.5 billion investment, rather an investment of about $4.5 billion. I use an algorithm derived from history, i.e. the life cycle cost of a submarine equals the acquisition cost, therefore, you have $1.5 billion in remaining acquisition plus about $3 billion in operations and maintenance. Accordingly, Mr. Chairman, you will be authorizing $4.5 billion to support the SSN-23 or 2% of the entire submarine force.

The other aspect of your position relates to the New Attack Submarine - the NAS. The House bill is a radical departure from the "business as usual" approach to submarine design.

There is absolutely no need to rush to a 1998 submarine that will be slower than its predecessor, carries fewer weapons and has less operating depth than its predecessor. I would also conjecture that there is no way on earth you will get this submarine for $1.2 or even $1.5 billion each.

Please recall that the SSN-21 class was supposed to cost $1.3 billion each and I advised this committee, as a member of your staff in 1986, that the cost would exceed $2.5 billion - its in your transcripts.

Your bill calls for competitive designs of the NAS. This means we keep two yards in the design business. If the intent of your bill is carried out, there will be commercial practices and hardware in the next generation submarine. Perhaps for the first time we will stop paying tens of thousands of dollars for pumps that are commercially available for less than a thousand dollars. Perhaps we will get away from expensive signal processor "number crunchers" and turn to commercially available processors and computers that do much more and cost much less. The NAS that you are asking for can, in my opinion, be built at a unit cost around $1.2 - 1.5 billion.

Mr. Chairman, Members of the Subcommittee, I am a strong proponent of our submarine forces. I believe that the Navy needs even more money than it requested this year. The low level of funding requested for the Office of Naval Research is borderline silly. There is no way that the U.S. could ensure technological superiority by spending a few tens of millions of dollars on basic research and exploratory development.

What is of equal, if not greater, importance than "how much" money we spend on submarine and anti-submarine warfare technology and systems is "how we spend" the money.

The House bill represents a good start on this latter issue. It's a first step in getting the Navy to change from an acquisition oriented submarine development approach to one that is performance oriented and concomitantly one that will allow us to surpass an outstanding Russian capability.

Mr. Chairman, you know better than I that the world order has changed. The strategic triad once consisted of bombers, submarines and intercontinental ballistic missiles. Today, however, I view one leg of our strategic triad being national defense, the second leg is our national economy and the third leg is our domestic problems - crime, drugs, etc. Our strength will be derived from the solution to these domestic problems, the solution to our economic problems - deficit reduction, etc. and selection of national defense programs that will ensure our superiority at the lowest practical cost. The new legs of our triad have even greater interdependence than the synergy among the three legs of the old triad.

The new submarine that this country builds will be with us beyond 2025. You have made this year the epoch for a completely new way of building submarines. I hope your position prevails. Twenty years from now, the fleet will be the beneficiary of the insurance policy that you wrote this year and it will be the Russians who will be trying to catch up.

ANTHONY R. BATTISTA

Mr. Battista retired from the Committee on Armed Services, U.S. House of Representatives, on February 15, 1988. He now provides strategic planning and technical consultation to several defense companies. He serves on the Board of Directors of two companies and was a consultant to the President's Science Advisor during the Bush Administration. Additionally, he has been a guest lecturer at several universities to include Georgetown and the University of Virginia.

Previously, he was with the Naval Weapons Laboratory (NWL), Dahlgren, Virginia, where he held the position of Supervisory Mathematician and Head of the Guidance and Control Division (1964-1974). His technical career at NWL included research in the various fields of mathematics and computer sciences and the development of radar, electro-optical, electronics and computer systems for shipboard applications. In 1963, he was employed as an Aerospace Engineer with the Manned Spacecraft Center of the National Aeronautics and Space Administration, Houston, Texas. In this position, Mr. Battista formulated and developed a significant part of the command program for the Agena/Gemini rendezvous manned space flight.

He has received several commendations and awards for superior achievement. He has a number of publications in various professional journals.

In addition to his professional career with industry and government, he has served as an instructor in mathematics and computer sciences at the Charles County Community College, La Plata, Maryland. He established the computer facility and the initial curriculum in data processing at the college and was the college's first instructor in its computer sciences program.

Mr. Battista received a Bachelor of Science degree in Mathematics from St. Francis College, Brooklyn, New York, a Masters degree from the University of Oklahoma and is a graduate of the Harvard University JFK School of Government program in International and Security Affairs. He is married to the former Doris M. Jordan of Port Royal, Virginia and has four children.

Mr. HUNTER. Dr. Foster.

STATEMENT OF JOHN S. FOSTER, JR., PRIVATE CONSULTANT, CURRENT MEMBER AND FORMER DIRECTOR, DEFENSE RESEARCH AND ENGINEERING, DEFENSE SCIENCE BOARD

Mr. FOSTER. Thank you very much, Mr. Chairman. I have a very brief statement, so with your permission, I will just read it.

Mr. HUNTER. Yes, sir.

Mr. FOSTER. At the outset I would like to thank you very much for providing transcripts of the committee's 1989 hearings on antisubmarine warfare, as well as some more recent information which was extremely useful to me in preparing this testimony.

I propose to briefly address four topics: First, indicators for the 21st century; second, the question of missions for attack submarines; third, my impressions of the planned U.S. submarine program; and finally, some recommendations.

When we try to think about the 21st century, we should realize that the missions for which we will need to use submarines will probably be different and have to be accomplished under conditions which are very different from the present. While we cannot know just what the 21st century will be like, there are three revolutions now going on that are likely to be the determinants of that future situation.

The first revolution is technological and has to do with the rate at which large nations, particularly Russia, China, and India, are improving their submarine capabilities. You will recall that during the last decade the Russians made very rapid improvements in the qualitative characteristics of their submarines, so that today the performance characteristics of their best boat is roughly the same as our best boat. However, a key concern is that their rate of improvement has been substantially greater than ours, and if we don't change our ways, they will attain qualitative superiority.

In addition, the rate at which they are producing submarines is higher than ours, so that that could place them in the 21st century with a larger number of submarines with qualitative superiority.

The second revolution is the proliferation of submarines and associated weapon systems that are being supplied by Russia, Sweden, Germany, France, and Great Britain to smaller nations around the world. Perhaps the most worrisome type is the air-independent propulsion diesel/electric submarines. These boats can be the most quiet submarines, with modern weapon systems and higher speed torpedoes. When operating in their littoral waters and cued by external regional sensors, they can place our large boats at a disadvantage.

The third revolution is driven by economics. As a consequence of budget reductions, we are downsizing our military forces. The current concern is that, in the process of downsizing, we may not choose to make the investments necessary to provide adequately and appropriately for a superior military capability in the 21st century.

Given these ongoing revolutions, it seems likely that for the 21st century the types of missions for submarines and their priority will be different. For example, we may not place highest priority on producing submarines which can outperform any adversary in a mid-ocean dogfight. Rather, we are likely to place highest priority on the use of submarines in critical roles associated with joint military operations in regional waters.

We call on submarines to perform different missions, and it is important to be clear on what mission is to be accomplished before developing advanced technology and applying it to a new submarine. The following identifies five missions and a salient characteristic for each:

A surveillance and reconnaissance mission, for which the submarine may have to carry specially configured payloads.

A land attack mission. For this mission, the submarine should have the ability to carry large numbers of ballistic and/or cruise missiles having ranges of up to, say, 1,500 miles.

Covert missions, which may require that the submarine have a large volume to permit the transport of a significant number of special operating forces.

An antisubmarine mission, which requires that the submarine be able to detect and identify a submarine as hostile and destroy it before being attacked, while operating in deep or shallow waters. This requires not only superior sensors, a rapid information processing and decision capability, but also a high speed torpedo.

An antiship mission which may require the use of cruise missiles to permit the submarine to be a greater distance from hostile ASW [antisubmarine warfare] systems.

From the above descriptions, it should be obvious that one configuration of an SSN will not be optimum for all missions, and so flexibility to reconfigure is important. But for any mission a submarine must be stealthy. Not only must it be very quiet, it must also have a minimum electromagnetic signature, cause disturbances that are not easily detected by any known sensors, and any structure that may appear above the water's surface must be difficult to detect by known sensors. It must also be able to rapidly detect and categorize the presence of objects above and below the water's surface.

Impressions: I have five impressions of current U.S. Navy objectives, strategies, plans, and programs which cause me to be quite concerned.

First, while we have had good intelligence over the years on the nature of the threat and we have conducted research, development, and test activities to address that threat, it seems to me that the application of those developments to new classes of submarines has taken entirely too long, particularly in the last half-dozen years. Now why is this so?

The declining budget is certainly one reason. The antisubmarine warfare RDT&E [research, development, test and evaluation] program budgeted in the mid-1980's at about $1.5 billion has declined and is now projected to decline further to about $500 million by the end of the FYDP. Unfortunately, the ASW [antisubmarine warfare] master plan appears to have fallen into disuse, which might suggest that ASW research and development is not high on the Navy's priority list.

The second reason is the DOD acquisition process. As the committee is well aware, Secretary Perry has launched a major effort to improve the acquisition process. However, even though the task has high priority, progress is very slow.

Because of our management approach and the resulting structural design of our submarines, major upgrades have required extensive changes which take a very long time and are very expensive. A recent example is the new SSN. In an effort to reduce cost, the new SSN has been reduced in size. The consequence is a reduction in flexibility. I am not persuaded that the resulting reduction in flexibility was the best way for the Navy to save money. I believe it will grow to accommodate priority missions of the 21st century and cost us even more money for upgrades in the outyears.

Our approach to operations aboard submarines requires that activities be conducted manpower intensive rather than automated. This approach will continue to demand large crews, large submarines, and high costs.

Further, the nature of the information and command control system requires the passage of too much time from the detection of a target, its classification, the decision to launch the appropriate weapon, and the time for the weapon to reach its target. During this period, we are especially vulnerable to attack.

Finally, the new world environment and new tactical environment are likely to require new weapons for attack and for self-defense. An increase in the tactical missile shooting rate of the submarine would be of great value in the 21st century conflict, but we see little effort to provide such a capability in a next-generation submarine for this mission.

Conclusions: From the above impressions, I come to two conclusions.

The first is that the Navy, faced with major budget reductions, has had to address a difficult strategic issue with regard to SSN's, whether to continue with the production of a new class of submarine or to initiate aggressive development and application of new technologies to overcome the challenges of the 21st century. My sense is that the Navy chose the first alternative, but couldn't see their way clear to provide funds for both.

My second conclusion is that the Navy's approach may not prepare us adequately for the 21st century. The ongoing revolutions, as well as our budget limitations, will demand large changes in how our submarine force is configured. I am not sure we well understand the missions which will need the submarine. I also know we have not fully digested the implications of new technology nor new ASW phenomena on the optimum design of our force.

However, a superior threat is more a potential threat, not one in being. Russia's recovery and stable government are still distant. Other nations which might be enemies are just beginning to digest the new military technologies. We have time to prepare our technology and pursue several prototype submarine types. At a reasonable budget level, I believe there is a more appropriate way for the undersea Navy to move into the 21st century.

Recommendations: In light of the above, I suggest that the Navy consider seriously the implementation of a paradigm shift in the way we pursue the development of advanced new submarines. The new way of doing business might employ the following eight recommendations.

First, we have a new world out there, and it calls on submarines to perform different missions with different priorities. I suggest that the Navy be requested to describe the various submarine missions and include a description of the characteristics which a submarine must possess in order to best accomplish the mission with minimal losses.

The Navy should generate an aggressive ASW master plan.

Arrange for ARPA [Advanced Research Projects Agency] to be a major partner with the Navy to contribute to the new thinking on SSN's and be an associate in all phases of the program. ARPA could be particularly helpful if it took the lead at the early, more speculative and pioneering stages. If the results were promising, the Navy would take the lead through to fleet operations.

Some Navy submarine missions can be accomplished just as well with a smaller, advanced nonnuclear submarine like the Australian *Collins* submarine. Of course, there are missions it cannot do as well as a nuclear submarine. But since it costs about a third as much, consider a mix as the best way to reduce costs.

Consideration should be given to the use of rapid prototyping for two or three generations over the next decade before settling on a new class of SSN.

In order to be able to perform the rapid prototyping of the different functions and for different missions, consider a submarine which is modular in design and designed specifically to accommodate upgrades. The purpose of this approach is to permit the rapid introduction of new generations in functional and mission capability.

For example, the reactor section and perhaps the machinery section might be one module, the weapons bay another, a surveillance module, an SOF module, and so on. This modular concept may also provide a convenient way to more quickly and cheaply convert a submarine from one mission to another mission, including timely upgrades.

Consider a paradigm shift in design philosophy. For decades we have used a mechanical engineering, cut and try approach, admittedly with considerable success. Consider launching an electrical engineering design philosophy. The new three-dimensional engineering tools, electric propulsion, active noise cancellation, automate functions aboard the submarine now performed manually, et cetera. All of these offer the possibility of higher performance at less cost.

To avoid many of the difficulties associated with the DOD acquisition process, consider using the advanced concept technology demonstrations in conducting the rapid prototyping.

Associated with a paradigm shift in the way the Navy develops technologies and produces submarines is the issue of rates. The rate of development of a new generation of technologies should match the rate at which new prototypes are to be produced. Unless the Navy undertakes a much more aggressive program to develop advanced technologies for submarines, the production of prototype submarines will be few and far between. This matter of rates will require a very careful revision of the programs and budgets of the Navy and ARPA.

In summary, I would hope that these eight initiatives might permit us to much more rapidly achieve qualitative superiority in each mission, particularly in the conduct of joint military operations.

Mr. Chairman, I thank you for this opportunity to share my views with this committee. I urge the committee to request that the Navy and ARPA present plans to achieve superiority across the full range of near-future submarine missions without specifying how they should do it. With your guidance and support, I am confident we can meet the challenge of the 21st century submarine warfare.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Foster follows:]

Testimony of John S. Foster, Jr.
Procurement Subcommittee of the House National Security Committee
Advanced Technology to the New Attack Submarine
September 7, 1995

Dear Mr. Chairman:

The following is offered as testimony in response to your request that I appear before your subcommittee on the application of advanced technology to a new attack submarine.

At the outset, Mr. Chairman, I wish to express my thanks to you for providing transcripts of the Committee's 1989 hearing on Anti-Submarine Warfare as well as more recent information, which was very helpful to me in preparing this statement.

I propose to briefly address four topics: first, indicators for the 21st century; second, the question of missions for attack submarines; third, my impressions of the planned US submarine program, and finally some recommendations.

The 21st Century

When we try to think about the 21st century we should realize that the missions for which we will need to use submarines will probably be different and have to be accomplished under conditions which are very different from the present. While we cannot know just what the 21st century will be like, there are three revolutions now going on that are likely to be determinants to that future situation.

The first revolution is technological and has to do with the rate at which large nations, particularly Russia, China and India are improving their submarine capabilities. You will recall that during the last decade the Russians made very rapid improvements in the qualitative characteristics of their submarines, so that today the performance characteristics of their best boat is roughly the same as our best boat. However, a key concern is that their rate of improvement has been substantially greater than ours and if we don't change our ways, they will attain qualitative superiority. In addition, the rate at which they are producing new classes of submarines is higher than ours so that could place them in the 21st century with a larger number of submarines with qualitative superiority.

The second revolution is the proliferation of submarines and associated weapon systems that are being supplied by Russia, Sweden, Germany, France and Great Britain to smaller nations around the world. Perhaps the most worrisome type is the air-independent propulsion diesel/electric submarines. These boats can be the most quiet submarines, with modern weapon systems and higher speed torpedoes. When operating in their littoral waters and queued by external regional sensors, they can place our large boats at a disadvantage.

The third revolution is driven by economics. As a consequence of budget reductions, we are downsizing our military forces. The concern is that, in the process of downsizing, we may not chose to make the investments necessary to provide adequately and appropriately for a superior military capability in the 21st century.

Missions

Given these on-going revolutions it seems likely that for the 21st century the types of missions for submarines and their priority will be different. For example, we may not place highest priority on producing submarines which can outperform any adversary in a mid-ocean dog fight. Rather, we are likely to place highest priority on the use of submarines in critical roles associated with joint military operations in regional waters.

We call on submarines to perform different missions and it is important to be clear on what mission is to be accomplished before developing advanced technology and applying it to a new submarine. The following identifies five missions and a salient characteristic for each.

- A surveillance and reconnaissance mission, for which the submarine may have to carry specially configured payloads.

- A land attack mission. For this mission, the submarine should have the ability to carry large numbers of ballistic and/or cruise missiles having ranges of up to, say, 1500 miles.

- Covert missions, which may require that the submarine have a large volume to permit the transport of a significant number of special operating forces.

- An anti-submarine mission, which requires that the submarine be able to detect and identify a submarine as hostile and destroy it before being attacked, while operating in deep or shallow (littoral) waters. This requires not only superior sensors, a rapid information processing and decision capability, but also a high speed torpedo.

- An anti-ship mission which may require the use of cruise missiles to permit the submarine to be a greater distance from hostile ASW systems.

From the above descriptions, it should be obvious that one configuration of an SSN will not be optimum for all missions, and so flexibility to reconfigure is important. But, for any mission a submarine must be stealthy. Not only must it be very quiet, it must also have a minimum electro-magnetic signature, cause disturbances that are not easily detected by any known sensors, and any structure that may appear above the water's surface must be difficult to detect by known sensors. It must also be able to rapidly detect and categorize the presence of objects above and below the water's surface.

Impressions:

I have five impressions of current US Navy objectives, strategies, plans and programs which cause me to be quite concerned.

- First, while we have had good intelligence over the years on the nature of the threat and have conducted research, development and test activities to address that threat, it seems to me that the application of those developments to new classes of submarines has taken entirely too long, particularly in the last half dozen years. Why is this so?

  - The declining budget is certainly one reason. The Anti-submarine Warfare RDT&E Program budgeted in the mid 80's at about $1.5B has declined and is now projected to decline further to about $500M by end of the FYDP. Unfortunately the ASW Master Plan appears to have fallen into disuse, which might suggest that the ASW research and development is not high on the Navy's priority list.

- A second reason is the DoD acquisition process. As the Committee is well aware, Secretary Perry has launched a major effort to improve the acquisition process. However, even though the task has high priority, progress is very slow.

- Because of our management approach and the resulting structural design of our submarines, major upgrades have required extensive changes which take a very long time and are very expensive. A recent example is the new SSN. In an effort to reduce cost, the new SSN has been reduced in size. The consequence is a reduction in flexibility. I'm not persuaded that the resulting reduction in flexibility was the best way for the Navy to save money. I believe it will grow to accommodate priority missions of the 21st century and cost us even more money for upgrades in the out years.

- Our approach to operations aboard submarines requires that activities be conducted manpower intensive rather than automated. This approach will continue to demand large crews, large submarines and high costs.

- Further, the nature of the information and command control system requires the passage of too much time from the detection of a target, its classification, the decision to launch the appropriate weapon and the time for the weapon to reach its target. During this period we are especially vulnerable to attack.

- Finally, the new world environment and new tactical environment are likely to require new weapons for attack and for self defense. An increase in the tactical missile shooting rate of the submarine would be of great value in the 21st century conflict, but we see little effort to provide such a capability in a next generation submarine for this mission.

Conclusions:

From the above impressions, I come two conclusions: The first is that the Navy, faced with major budget reductions, has had to address a difficult strategic issue with regard to SSN's: whether to continue with the production of a new class of submarine or, to initiate aggressive development and application of new technologies to overcome the challenges of the 21st Century. My sense is that the Navy chose the first alternative but couldn't see their way clear to provide funds for both.

My second conclusion is that the Navys' approach may not prepare us adequately for the 21st Century. The on-going revolutions as well as our budget limitations will demand large changes in how our submarine force is configured. I am not sure we well understand the missions which will need the submarine. I also know we have not fully digested the implications of new technology nor new ASW phenomenon on the optimum design of our force.

However, a superior threat is more a potential threat not one in being; Russia's recovery and stable government are still distant; other nations which might be enemies are just beginning to digest the new military technologies. We have time to prepare our technology and pursue several prototype submarines types. At a reasonable budget level I believe there is a more appropriate way for the undersea Navy to move into the 21st Century.

Recommendations:

In light of the above, I suggest that the Navy consider seriously the implementation of a paradigm shift in the way we pursue the development of advanced new submarines. The new way of doing business might employ the following eight recommendations.

- First, we have a new world out there and it calls on submarines to perform different missions and with different priorities. I suggest that the Navy be requested to describe the various submarine missions and include a description of the characteristics which a submarine must possess in order to best accomplish the mission with minimal losses.

- The Navy should generate an aggressive ASW Master Plan.

- Arrange for ARPA to be a major partner with the Navy to contribute to the new thinking on SSN's and be an associate in all phases of the program. ARPA could be particularly helpful if it took the lead at the early, more speculative and pioneering stages. If the results were promising, the Navy would take the lead through to fleet operations.

- Some Navy submarine missions can be accomplished just as well with a smaller, advanced non-nuclear submarine like the Australian "Collins" submarine. Of course, there are missions it cannot do as well as a nuclear submarine. But, since it costs about one-third as much, consider a mix as the best way to reduce costs.

- Consideration should be given to the use of rapid prototyping for two or three generations over the next decade before settling on a new class of SSN.

- In order to be able to perform the rapid prototyping of the different functions, and for different missions, consider a submarine which is modular in design and designed specifically to accommodate upgrades. The purpose of this approach is to permit the rapid introduction of new generations in functional and mission capability. For example, the reactor section and perhaps the machinery section might be one module, the weapons bay another, a surveillance module, a SOF module, and so on. This modular concept may also provide a convenient way to more quickly and cheaply convert a submarine from one mission to another mission, including timely upgrades.

- Consider a paradigm shift in design philosophy. For decades we have used a mechanical engineering, cut and try approach, admittedly with considerable success. Consider launching an electrical engineering design philosophy. The new 3D engineering tools, electric propulsion, active noise cancellation, automate functions aboard the submarine now performed manually, etc. - all these offer the possibility of higher performance at less cost.

- To avoid many of the difficulties associated with the DoD acquisition process, consider using the Advanced Concept Technology Development (ACTD) process in conducting the rapid prototyping.

In summary, I would hope that these eight initiatives might permit us to much more rapidly achieve qualitative superiority in each mission particularly in the conduct of joint military operations.

Mr. Chairman, I thank you for this opportunity to share my views with this Committee. I urge the Committee to request that the Navy and ARPA present plans to achieve superiority across the full range of near future submarine missions without specifying how they should do it. With your guidance and support I am confident we can meet the challenge of the 21st century submarine warfare.

Mr. HUNTER. Thank you, Dr. Foster. Thank you for your contributions in nuclear weapons development and stealth and maritime issues and all of the great—the tens of thousands of hours that you have given to this country. We appreciate you as a national asset.

I would now like to call on Norman Polmar, and, Norman, I got a chance to look at his, I guess his most famous book about Admiral Rickover, the Admiral Rickover book last night, Norman Polmar is of all the people who follow submarine development and have followed the Soviet—then Soviet Union versus United States and now Russia versus United States contest in undersea superiority, probably nobody has studied it more or written more about it than Norman Polmar.

And, Mr. Polmar, we are all familiar with your writings. We appreciate your being part of this important panel. Thanks for being with us today. What should we do with submarines?

STATEMENT OF NORMAN POLMAR, NAVAL ANALYST, AUTHOR/COLUMNIST, LECTURER, AND CONSULTANT TO THREE FORMER SECRETARIES OF THE NAVY

Mr. POLMAR. Thank you very much. We should do something very constructive, because the former Soviet Union, Russia, which is today a Third World country, its political system is falling apart; its economy, its industry, its military forces are all in disarray, and yet we see three areas in which they are still continuing significant developments and three areas in which they are competitive and possibly superior to us—military use of space, tactical aircraft, and submarines. This emphasis on submarines was revealed earlier this year to this committee when the Chief of Naval Operations, Admiral Mike Boorda, told us about the improved *Akula* class submarine, and I quote the Admiral:

"This is the first time since we put the Nautilus to sea that the Russians have had submarines at sea quieter than ours. As you know, quieting is everything in submarine warfare."

You ladies and gentlemen have certainly recognized the importance of submarines to this country, and they are vital. You have funded, since the cold war began right after World War II, 21 diesel/electric submarines and 208 nuclear submarines. The latest submarine that you have funded, the second *Seawolf*, is a $3 billion submarine.

But, ladies and gentlemen, while providing this formidable submarine force, in my opinion, you have failed to ensure that the United States maintains qualitative superiority over foreign submarine technology. For decades, we have been told that quieting—stealth in the popular vernacular—was the most important attribute of a submarine.

To maintain superiority and quieting, the U.S. Navy has sacrificed many submarine attributes—speed, depth, weapons payload, unsinkability, the advantages of double hull construction, and certain other features—all in the name of quieting, stealth.

The Soviets, the Russians, have not done this. They have continued to develop these other areas, and they have surprised us on too many occasions. They have surprised us in depth. For example, the *Mike* or *Komsomolets*, a fully operational attack submarine had an operating depth of 3,000 feet. She was lost to a fire unrelated to her combat capabilities.

Speed: The Soviet *Papa* class guided missile submarine went 44.7 knots on trials. They have surprised us with hull coatings, high density nuclear plants, hydrodynamic design, quiet double hull designs.

A statement was made before the House Armed Services Committee 15 years ago by a major figure in the nuclear submarine program of the United States who said, you cannot produce a quiet double hull submarine. Every Russian combat submarine, including the quiet *Akulas* are double hulled. They have surprised us with automation, strategic weapon ranges, wake-homing torpedoes, large-diameter torpedoes, large-warhead torpedoes and now high-speed torpedoes with a speed, a published speed of approximately 180 knots. They have surprised us, and I agree completely with Mr. Battista that we must link submarines and ASW with nonacoustic ASW. They are way ahead of us in that field.

As the Soviet submarine force has gained superiority in these areas I have just elaborated on, United States submarine leaders have held the view that the United States force was superior because of our lead in acoustics or quieting. There were, however, ominous signs that the Russians were making progress in quieting. In 1989 Admiral Tom Brooks, then Director of Naval Intelligence, declared the *Akula*, which came out a few years before, "produces noise levels that the United States had not predicted the Soviets to attain until the early 1990's." Soviet quieting technology was several years ahead of where we predicted it would be. The gap was closing.

The appearance of the *Akula* and several other so-called third generation Soviet submarines demonstrated that Soviet submarines were closing the gap in acoustics. We knew it 10 years ago, we knew it 5 years ago. A few years after Admiral Brooks' statement, last year, 1994, it became known that the gap had been closed when the improved *Akula* SSN's were determined to be quieter than the latest American submarines at sea, the improved *Los Angeles*, or 688I.

Let me say, the Soviets, Russians—Soviet design, now it is the Russians operating it—today apparently have at sea on trials a submarine more advanced than the improved *Akula*. It is the *Akula II*. It is a longer submarine. You lengthen a submarine usually for one of two reasons, improved weapons or improved quieting; it is anybody's guess in the West. From the indications I have from the Russians I deal with in the submarine design business, it is quieting.

On December 21, 1993, the keel was laid for *Severodvinsk*, the first fourth-generation SSN. U.S. naval analysts contend that that submarine will be only slightly quieter than the improved *Akula*. This issue of quieting is a vital program, a vital issue because the follow-on to the truncated *Seawolf* program, called the New Attack Submarine, will have the same quieting level as the *Seawolf*; it will not be quieter. For first time in 30-some years, we have designed a submarine that is not quieter than its predecessor. Because the new attack submarine is cost constrained, we have made it smaller, with fewer weapons, less speed and a reduction in certain other capabilities.

Ladies and gentlemen, I project that if the past is any guide to the future, it is more likely that the improved submarines now being built, the *Severodvinsk,* the *Akula II* will be significantly quieter than the approved *Akula,* and quieter than the *Seawolf,* which was designed several years before the *Severodvinsk.* Yet because of the economic and political conditions in Russia today, which prevent them from building large numbers of these submarines at a rapid rate, we have a window of opportunity. Over the next few years their development will continue; their mass production, which we saw in the 1950's, 1960's, 1970's, and 1980's, will not continue. We have a window in which hopefully the United States can, one, objectively evaluate the submarine situation and the relative importance of various submarine characteristics, including quieting; and, two, pursue innovative approaches to regaining submarine superiority for the United States.

In my paper, I respectfully submit to the committee four suggestions for us regaining superiority:

First, what I call a viable submarine development program, where we immediately initiate competitive submarine design programs at General Dynamics/Electric Boat and at Newport News. Both yards should be given contracts, and in the case of Electric Boat, probably, to modify the New Attack Submarine as they feel reasonable to do so to provide advanced prototype submarines. Let's take this window and not build a prototype to build immediately follow it with a class of 20 or 30 submarines which will be with us until the year 2040 or 2050, but let these two outstanding yards compete in design and in construction of advanced submarines. Then when we have their detailed designs in a couple of years and they are already building the prototypes, we can decide if we want more prototypes. Again, I have outlined this in my paper.

Second, restart the Defense Advance Research Projects Agency [DARPA] SubTech Program. This program, which was initiated in 1987 by Congress and was absorbed by the Navy in 1991, was one of the most effective technology innovation programs in American history. It is vital to start this outside of the normal submarine design and development community. We have right now an excellent organization within the Navy for research, the Office of Naval Research. We have DARPA. Those two should be given a program to continue to push the envelope.

Congress recognized this in the late 1980's, that the submarine community, busy building submarines, could not develop the next generation and the follow-on. So it is vital, in my opinion, to restart this program, reinvigorate it within DARPA with very close support, as I say in my paper, from the Office of Naval Research.

Third, develop a red team approach to objective review. U.S. Navy submarine programs must be reviewed by an objective, non-Navy group to bring a noninstitutional review to these important efforts. The Aspin committee was certainly one example of this, the Central Intellgence Agency [CIA] B Team set up in the 1970's to review our strategic estimates of Russian strategic forces. Such a panel comprised of nonsubmarine specialists from multiple disciplines should be established for a period of at least 3 to 5 years, and the team should report directly to the Secretary of the Navy and the Chief of Naval Operations [CNO], as well as to Congress. We must have this objective viewpoint, again which Congress has given but is unable to concentrate on.

Fourth, we must give the Navy a structure conducive to progress.

Let me conclude with this: Congress and the Navy's leadership should review the current structure within the Navy for designing submarines. The Nuclear Propulsion Directorate was established in the late 1940's, with its director, then-Captain H.G. Rickover, double-hatted to the Atomic Energy Commission, now the Department of Energy. That organization has served the Navy and the Nation very well for many years, developing a most enviable safety record for nuclear propulsion and for personnel training.

However, both safety and training have now been highly institutionalized within the Navy. The situation of having a four star director of submarine reactor safety and training who has a direct influence on submarine design and in some respects more influence than the commander of the Naval Sea Systems Command, who has three stars; or the senior submarine force commander, three stars; or the submarine program manager, two stars, should be carefully and objectively reviewed.

Russian submarine technology is no longer catching up. It has surpassed us in many areas, including today quieting, considered by many experts to be the key factor in submarine warfare.

We have a window of opportunity here to change things while there is no direct threat from Russia or any other major power to the United States. I implore you, ladies and gentlemen, please take advantage of this window for the sake of the Navy and the sake of the Nation. Thank you.

Mr. HUNTER. Mr. Polmar, thank you very much. Thank you for your contribution to our country.

[The prepared statement of Mr. Polmar follows:]

STATEMENT BEFORE THE

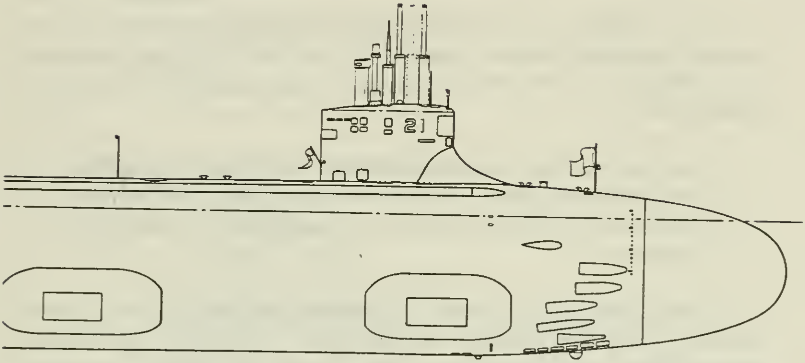
COMMITTEE ON NATIONAL SECURITY

HOUSE OF REPRESENTATIVES

By

NORMAN POLMAR

7 September 1995



[*Revised*]

Statement by Norman Polmar

Committee on National Security

House of Representatives

7 September 1995

Today Russia is a Third World country. Its political system, its economy, its industry, and its military forces are all in disarray. Yet we see three areas of military technology that the Russians are continuing to develop at a significant rate, areas in which they are competitive if not superior to the United States. These areas are:

- Military use of space
- Tactical aircraft
- Submarines

This emphasis was revealed earlier this year when Admiral J.M. Boorda, the Chief of Naval Operations, to told this committee about the analyses of the noise levels of the Improved Akula-class submarine:

> This is the first time since we put NAUTILUS to sea that [the Russians] have had submarines at sea quieter than ours. As you know, quieting is everything in submarine warfare.[1]

Submarines are important to the defense posture of the United States. They are valuable in peacetime, in crisis, and in war. The Congress has recognized this importance, having funded 21 diesel-electric submarines and 208 nuclear submarines during the past 50 years. The latest submarines that you have funded cost some $3 billion per submarine.

But while providing this formidable submarine force you have failed to insure that the United States has maintained qualitative superiority over foreign submarine technology. For decades we have been told that quieting--"stealth" in the popular vernacular--was the most important attribute of a submarine.

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[1] Adm. J.M. Boorda, USN, testimony before National Security Committee, House of Representatives, 22 February 1995.

To maintain superiority in quieting the U.S. Navy has sacrificed many submarine attributes: speed, depth, weapons payload, "unsinkability," the advantages of double-hull construction, and certain other features.

The Soviet Union sought to retain these features in their submarines. In doing so the Soviets have continually surprised us; the following list reflects areas in which Soviet developments were unexpected by most Western submarine analysts:

Submarine Performance

- Depth
    - Alfa SSN (2,000-2,500 ft)
    - Mike SSN (3,000+ ft)
- Speed
    - Alfa SSN (43 knots)
    - Papa SSGN (44.7 knots)

Submarine Hull-Machinery-Electrical

- Hull coatings
    - anechoic
    - self-quieting
    - drag reduction
- High-density nuclear plants
- Hydrodynamic design
- Quiet double-hull designs
- Automation

Submarine Weapons

- Strategic missile ranges
- Wake-homing torpedoes
- Large-diameter torpedoes (650-mm)
- Large-warhead torpedoes
    - 1,000+ pounds for Soviet torpedoes (approx. 650 pounds for U.S. Mk 48)
- High-speed torpedoes (approx. 180 knots)

Submarine/ASW Sensors

- Non-acoustic anti-submarine warfare
  - satellite
  - in situ wake detection

As the Soviet submarine force gained superiority in these areas, U.S. submarine leaders held to the view that the U.S. submarine force was superior because of our lead in acoustics or quieting. There were, however, ominous signs that the Soviets were making progress in submarine quieting:

In the early 1980s the third generation of Soviet submarines began going to sea. American SSNs trailing those undersea craft and SOSUS detections discovered noise levels much lower than predicted.[2] Rear Admiral Thomas A. Brooks, then-Director of Naval Intelligence, explained, "[the] Akula produces noise levels that the U.S. had not projected the Soviets to attain until the early 1990s."[3] The Soviet quieting technology was several years ahead of U.S. intelligence predictions--the gap was closing more rapidly than expected.

Concern for Soviet advances in quieting led a senior U.S. submarine designer to declare, "there will come a time in the not too distant future when Soviet submarine silencing will have improved to the extent that detection by passive sonar is possible

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[2] The Soviet third-generation submarines were:

Type	NATO name	Project No.	Completed
SSGN	Oscar	949	1982
SSBN	Typhoon	941	1983
SSN	Sierra	945	1984
SSBN	Delta IV	667BDRM	1985
SSN	Akula	971	1985

SOSUS is the seafloor SOund SUrveillance System.

[3] Rear Adm. Brooks, testimony before the Seapower, Strategic, and Critical Materials Subcommittee of the House Armed Services Committee, 22 February 1989.

only at short ranges, if at all."[4] This view was subsequently confirmed by a top-level study panel sponsored by the House of Representatives, which concluded that because of Soviet submarine developments, "We believe that the [U.S.] Navy must, in effect, 'start over' in its approach to ASW."[5]

Addressing specific Soviet submarine developments--called into focus by the unexpected low noise levels of the Akula--the report continued:

> ... it is true that the Soviets' submarine R&D [research and development] program is extremely ambitious, [it] seems to over-look no promising technologies, and--in that it dates back many years--is no flash in the pan. As a result of their years of intensive research it appears that the Soviets may well be ahead of us in certain technologies, such as titanium structures and control of the hydrodynamic flow around a submarine.
>
> But far more important is the improvement that the Soviets have made in submarine quieting. The problem is not that Soviet submarines are now quieter than ours; they are not. But after decades of building comparatively noisy submarines, the Soviets have now begun to build submarines that are quiet enough to present for us a major technological challenge with profound national security implications.[6]

This pivotal study by the House of Representatives should have rung alarm bells throughout the U.S. submarine and R&D communities.

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[4] Capt. Harry A. Jackson, U.S. Navy (Ret.), et. al., "ASW: Revolution or Evolution," U.S. Naval Institute Proceedings (September 1986), p. 68

[5] Report of the Advisory Panel on Submarine and Antisubmarine Warfare to the Subcommittees on Research and Development, and Seapower and Strategic and Critical Materials, House Armed Services Committee, 30 January 1989, p. 2.

[6] Report of the Advisory Panel, Appendix, p. 1.

But it appears to have had little impact on the U.S. submarine leadership.

However, the report did reinforce congressional support of the important Submarine Technology program of the Defense Advanced Research Projects Agency (DARPA), and several analytical efforts by the Central Intelligence Agency and private study organizations.

The appearance of the Akula and other third-generation Soviet submarines demonstrated that the Soviet submarines were closing the quieting gap faster than expected. A few years later--in 1994--it became known that the gap had been closed when the Improved Akula SSNs were determined to be quieter than the latest American submarines at sea--the Improved LOS ANGELES (688I) class.

On 21 December 1993 the keel was laid down for the SEVERODVINSK (Project 885), the fourth-generation Soviet-Russian SSN. U.S. naval analysts contend that the SEVERODVINSK SSN will be only slightly quieter than the Improved Akula (see Figure 1).

The leadership of the U.S. nuclear submarine community believes that the next U.S. submarine, the SEAWOLF, will be the world's quietest submarine when she goes to sea in 1996. Quieting was the highest priority in the design of the SEAWOLF.

A vital question is how quiet will the SEVERODVINSK be? The U.S. Navy's intelligence estimate--driven to a significant degree by the nuclear submarine community--indicates that the SEVERODVINSK will have almost the same noise levels as the Improved Akula. This has become an important issue because the New Attack Submarine (NSSN), the follow-on to the truncated SEAWOLF program, will have the same level of quieting as the earlier SEAWOLF. Most if not all other NSSN characteristics will be inferior to those of the SEAWOLF (speed, weapons, etc.).

Reviewing the Soviet-Russian "surprises" in submarine quieting in the early 1980s and again in 1994, one must be apprehensive of U.S. predictions in this area. Why assume that the rate of improvement of Russian broad-band quieting between the improved Victor III submarine and the Improved Akula will not be continued? If it is, the SEVERODVINSK would be as quiet--and possibly quieter

--than the SEAWOLF and NSSN.

In general, our performance predictions are based on the characteristics of older Russian submarines as they come out of overhauls, often revealing lower noise levels. There are other sources--both open and clandestine--that shed light on future Russian submarine developments. But if the past is any guide to the future, it is more likely that the SEVERODVINSK will be significantly quieter than the Improved Akula--and quieter than the SEAWOLF, which was designed several years before the SEVERODVINSK. Discussions that I have had with senior officials of Russia's Rubin and Malachite design bureaus reinforce the view that future Russian submarines will be quieter and have improved performance.[7] Based on available information, there is little reason to believe that the Russian Navy will not maintain its new found leadership in submarine quieting.

* * *

Significantly, the displacement or volume growth of Soviet submarines has not been proportional to their improvements in quieting. The U.S. Navy has used primarily an "add-on" method of quieting wherein each submarine design followed the basic SKIPJACK configuration (i.e., ALBACORE [AGSS-569] "tear-drop" hull and S5W reactor plant) with changes made to counter specific noise sources. The Soviets appear to employ more of a "systems approach" with successive submarine designs having an overall, integrated quieting effort. Significantly, Soviet-Russian quieting has been accomplished without the major increases in size that have accompanied U.S. submarine quieting efforts. For example, as shown in Figure 1, the Alfa submarine was quieter than the Victor I design but the Alfa was both smaller and faster:

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[7] Rubin and Malachite are the Russian submarine design bureaus, both located in St. Petersburg. Mr. Polmar visited the Rubin bureau for technical discussions in November 1992, May 1994, and September 1994; he also visited the Malachite bureau in September 1994. Academician I.G. Spassky, head of the Rubin bureau, was Mr. Polmar's guest in the United States in October 1993 for further discussions.

NATO name	Project	Displacement	Horsepower	Speed
Victor I	671	5,000 tons	30,000 shp	33 knots
Alfa	705	3,800 tons	47,000 shp	43 knots

These and other advances have been possible, in large part, because of the high degree of independence of the three Soviet submarine design bureaus: Rubin and Malachite in Leningrad/St. Petersburg, and Lazarite in Gor'kiy/Nizhny Novgorod, and several related research institutes.[8] In contrast, U.S. submarine research, development, and design efforts are very closely and narrowly controlled by the Naval Nuclear Propulsion Directorate.

Early on the Soviets worked at reducing hydrodynamic flow noises. This can be seen by the blending of sail into the hull, flow-control structures (strakes), covers over limber holes, and other features, some of which are now incorporated into the U.S. SEAWOLF design. Soviet-Russian propulsion quieting includes rafting of turbines (introduced in the Victor SSN), advanced propeller designs, and other features also employed in U.S. submarines. Also, building on German development of the Alberich anechoic coatings in World War II, the Soviets have developed what appear to be multi-purpose coatings, which reduce the effectiveness of Allied homing torpedoes by absorbing their active sonar pulses and also help to mask internal noises. The Russians are reported to employ multiple coatings in their double-hull submarines, further masking internal noises. (The coatings may also affect water flow over the hull, reducing flow noises as well as cutting drag.)

The Russians also reduce submarine noises including a unique scheme of active noise cancellation. This method of quieting measures certain noise frequencies and produces--in real time--a cancelling tone. There are also indications that the Russians have tested the injecting of polymer substances into a turbulent boundary layer around submarines not only to reduce drag and possibly to reduce flow noises. This scheme would be particularly important for increasing "quiet speed," the speed at which a submarine can still use its own passive sonar.

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[8] Lazarite apparently no longer designs combat submarines.

* * *

The current political and economic conditions in Russia mitigate against an effective submarine program. The SEVERODVINSK is known to be significantly behind schedule, and the follow-on, fifth-generation Russian SSN, whose design is well underway, is far from being funded. Still, if quieting is the key to U.S. nuclear submarine effectiveness--as long touted by the U.S. submarine community--there are rough waters ahead.

In my opinion there is a "window of opportunity" over the next few years as Russian submarine development, despite technological progress, is in disarray because of the general situation of the Russian state and armed forces. Hopefully the United States can take advantage of this window in time to (1) objectively evaluate the U.S. submarine situation and the relative importance of various submarine characteristics, including quieting, and (2) pursue innovative approaches to regaining submarine superiority.

I would respectfully propose to this committee consideration of the following actions. I would stress that these actions are possible today--in our window of opportunity--and could not have been undertaken during the Cold War because we could not risk slowing the production of submarines.

Accordingly, I propose:

1. A Viable Submarine Development Program: Appendix A to this statement provides a list of all nuclear-propelled submarine designs put to sea by the United States and the Soviet Union-Russia.

During the 1950s and 1960s the U.S. Navy had a viable and innovative submarine development program. Note the large number of designs developed by the United States during this period; but the decades of the 1970s and 1980s saw Soviet innovation come forth. I submit that continuing the currently planned U.S. Navy program of submarine development--building the third SEAWOLF and beginning the New Attack Submarine (NSSN) in Fiscal 1998--will not regain underwater superiority for the United States.

Rather, the United States should initiate competitive submarine design programs at the General Dynamics/Electric Boat and the Newport News Shipbuilding yards. The yards should each design and construct an Operational Prototype (OP) of an advanced combat submarines that could serve as the model for series production. As detailed designs are completed, the Navy could initiate production of the more promising OP design in Fiscal 2002 or, alternatively, continue this "fly-before-you-buy" concept by pursuing additional Operational Prototypes.

The following is a proposed schedule for this concept:

FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003
OP-1 (Electric Boat)	OP-2 (Newport News)	Design Review	Design Review	New SSN Production *or* OP-3	New SSN Production *or* OP-4

I would stress that these Operational Prototype submarines would be fully combat capable--as were the prototype U.S. NAUTILUS and SEAWOLF, and the Soviet Mike (KOMSOMOLETS), the latter built to evaluate 12 advanced technologies while having an attack submarine combat capability.

This program would cost more than now planned for the NSSN program, but an innovative approach--which does not commit the United States to producing submarines inferior to foreign undersea craft--must be undertaken.

2. Restart the SubTech Program: Congress should immediately reinstate the DARPA Submarine Technology (SubTech) program that Congress initiated in 1987 and continued for several years until it

was absorbed by the Navy in 1991. This program was one of the most innovative technology efforts undertaken by the U.S. defense establishment since the founding of DARPA in the late 1950s.

This effort is needed because, as the House Armed Services Committee's ASW report of 1989 stated, "the Navy establishment--like many organizations of comparable size and age--is burdened with traditional, deeply rooted, and powerful vested interests that encumber innovation on the scale required" to counter Soviet-Russian developments.[9] This situation remains true today, although some progress has been made by the Office of Naval Research under its current director.[10]

This vital effort could be initiated at the cost of as little as $150 million per year in an Advanced SubTech program jointly directed by DARPA and the Office of Naval Research. The actual research and development activities would be undertaken by the Navy's laboratory complex, the Los Alamos and possibly Livermore national laboratories, and private contractors.

3. A Red Team Approach to Objective Review: U.S. Navy submarine programs must be reviewed by an objective, non-Navy group to bring a non-institutional review to these important efforts before they are formally proposed for Milestone 0 review. The effectiveness of this scheme have been demonstrated by the Defense Science Board, the Naval Research Advisory Committee (NRAC), and Chief of Naval Operations Executive Panel reviews of various Navy programs.

This concept--using a review by non-institutional personnel who seek objectivity--is akin to the B-Team set up by the Central Intelligence Agency in 1975 to help obtain objective reviews of its estimates of Soviet strategic force development. Such a submarine-oriented Red Team should be comprised of non-submarine specialists, from multiple disciplines, and should be established for a period of at least three to five years. The team should report directly to the Secretary of the Navy and Chief of Naval Operations.

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[9] Report of the Advisory Committee, p. 1.

[10] The current Chief of Naval Research (ONR), Rear Adm. Marc Y.E. Pelaez, was previously assigned to the DARPA SubTech program.

4. A Structure Conducive to Progress: Congress and the Navy's leadership should review the current structure within the Navy for designing submarines. The Naval Nuclear Propulsion Directorate (code NAVSEA-08) was established in the late 1940s, with the director, then-Captain H.G. Rickover, double-hatted to the Atomic Energy Commission (now Department of Energy). That organization served the Navy and the nation well for many years, developing a most enviable safety record for naval nuclear propulsion and for personnel training.

However, both safety and training have now been highly institutionalized within the Navy. The situation of having a four-star director of safety/training, who has direct influence on submarine design and--in some respects--more influence than the Commander, Naval Sea Systems Command (three stars) or the senior Submarine Force Commander (three stars), or the submarine program manager (two stars) should be carefully and objectively reviewed.

The incumbent Director, Naval Nuclear Propulsion, Admiral Bruce DeMars, is scheduled to retire in 1996 after an eight-year tenure, thus there is an opportunity for Congress and the Navy's leadership to review this structure. Several proposals are already being developed for a restructuring.

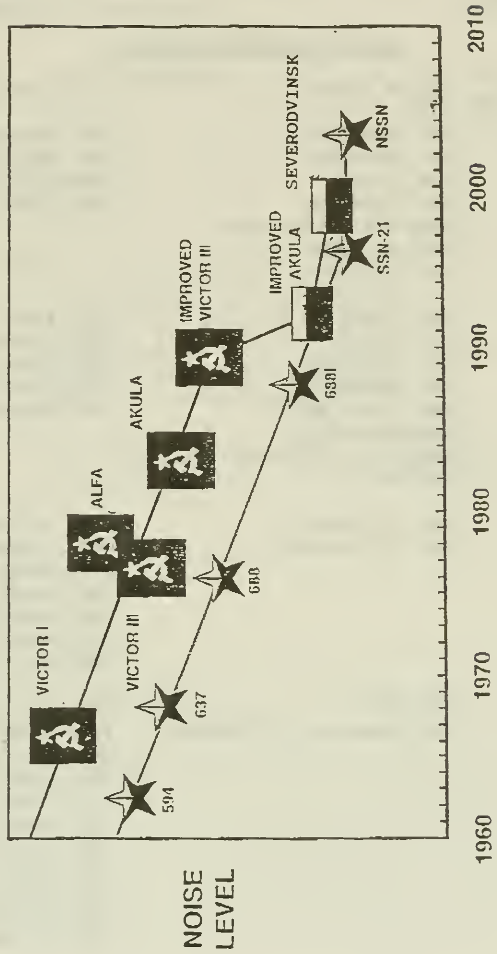
* * *

Russian submarine technology is no longer "catching up" with our submarine force. It has surpassed us in many areas--including quieting, considered by many experts to be the key factor in submarine warfare.

The third SEAWOLF and the New Attack Submarine will not return leadership in submarine warfare to the United States. To do so we require a high priority national effort, a new approach to submarine development, an increase in funding, and an improved Navy submarine organization.

Thank you for the opportunity to present my views to you.

FIGURE 1 Submarine Broad-Band Quieting



APPENDIX A

Nuclear Submarine Designs

	United States	*Soviet Union-Russia*
1955-1960	SSN NAUTILUS* SSN SEAWOLF* SSN SKATE SSN SKIPJACK SSBN GEO. WASHINGTON SSGN HALIBUT* SSRN TRITON*	SSN November SSN Mod. November (#645)* SSBN Hotel SSGN Echo I
1961-1970	SSN THRESHER SSN TULLIBEE* SSN STURGEON SSN NARWHAL* SSBN ETHAN ALLEN SSBN LAFAYETTE SSBN BENJ. FRANKLIN SSXN NR-1*	SSN Alfa SSN Victor I SSGN Echo II SSGN Charlie I SSBN Yankee
1971-1980	SSN LIPSCOMB* SSN LOS ANGELES	SSN Victor II SSN Victor III SSGN Papa* SSGN Charlie II SSBN Delta I SSBN Delta II SSBN Delta III
1981-1990	SSBN OHIO SSN Improved LOS ANGELES	SSN Sierra I SSN Sierra II SSN Mike* SSN Akula SSGN Oscar I SSGN Oscar II SSBN Delta IV SSBN Typhoon SSXN X-Ray* SSXN Uniform SSXN Pultas

APPENDIX A [*continued*]

1991-2000	SSN	SEAWOLF	SSN	Improved Akula
			SSN	Akula II
			SSN	SEVERODVINSK

NOTES

* = One-of-a-kind submarine
SSN = torpedo attack submarine
SSBN = ballistic missile submarine
SSGN = guided (cruise) missile submarine
SSRN = radar picket submarine
SSXN = research/special purpose

Major submarine conversions are not included (e.g., Yankee SSGN variants, Yankee SSN, Yankee SSXN).

APPENDIX B

Non-Nuclear Submarine Designs

	United States		*Soviet Union-Russia*	
1950-1960	SS	TANG	SS	Whiskey
	SS	DARTER*	SS	Zulu
	SS	BARBEL	SS	Quebec
	SSK	K-1	SS	Romeo
	SSG	GRAYBACK	SS	Foxtrot
	SSR	SAILFISH	SSB	Zulu
	AGSS	ALBACORE*	SSB	Golf
	SST	T-1	SSX	Whale*
1961-1970	AGSS	DOLPHIN*	SSG	Juliett
			SST	Bravo
1971-1980	(none)		SS	Tango
			SSX	Lima*
			SSX	India
1981-1990	(none)		SS	Kilo
			SSX	Beluga*

NOTES

* = One-of-a-kind submarine
SS = torpedo attack submarine
SSB = ballistic missile submarine
SSG = guided (cruise) missile submarine
SSR = radar picket submarine
SST = training/target submarine
SSX = research/special purpose

Major submarine conversions are not included (e.g., three Whiskey SSG and one Whiskey SSB conversions).

NORMAN POLMAR

Norman Polmar is an analyst, historian, and author specializing in naval and strategic issues. He has served as a consultant to three Secretaries of the Navy, three members of the U.S. Senate, one member of the House of Representatives, and the Director of the Los Alamos National laboratory as well as to the Deputy Counsellor of President Reagan. He also served from 1982 to 1986 as a member of the Secretary of the Navy's Research Advisory Committee (NRAC).

Since 1980, as an independent consult, he has conducted or participated in studies for several U.S. and foreign aerospace and shipbuilding firms, as well as to various offices of the U.S. Navy and Department of Defense.

Prior to 1980 he was an analyst and executive with corporations involved in defense studies.

Mr. Polmar has written or coauthored more than 30 books. These include coauthoring with Thomas B. Allen the best-selling biography Rickover: Controversy and Genius (1982). His submarine-related books include Atomic Submarines (1963), Death of the Thresher (1964), American Submarines (1981), Submarines of the Imperial Japanese Navy (1986), and Submarines of the Russian and Soviet Navies, 1718-1990 (1991). In addition, he is author of the Naval Institute reference books The Ships and Aircraft of the U.S. Fleet and Guide to the Soviet Navy, both published at three-year intervals. These are considered to be the definite reference books in their fields.

He is currently writing a history of submarine design during the Cold War era in collaboration with Academician I.G. Spassky, head of the Rubin submarine design bureau, and Viktor Semyonov of that bureau, former deputy to S.N. Kovalev, designer of the Yankee, Delta, and Typhoon submarines.

Mr. Polmar's articles and comments have been published in numerous newspapers as well as popular and professional journals in the United States and abroad. He writes a regular column for the Naval Institute Proceedings, the Navy's professional journal.

From 1967 to 1977, Mr. Polmar was the editor of the U.S. and several other sections of the annual Jane's Fighting Ships. The first American to ever hold an editorship with that publication, he was totally responsible for almost one-third of the volume in that period.

Mr. Polmar has previously testified before House and Senate subcommitteees, and is frequently featured in numerous television and radio news and feature shows discussing defense issues.

He has lectured on strategic and naval subjects to various defense, naval, and private organizations in the United States, Russia, China, Canada, Japan, Israel, Germany, Denmark, and Great Britain. He has been a periodic speaker at the U.S. Naval Academy (Annapolis), U.S. Defense Intelligence College (Washington, D.C.), U.S. Naval Postgraduate School (Monterey), and Royal Naval College (Dartmouth).

He has made several visits to Russia and China as a guest of their respective government agencies, and has traveled extensively in Europe, the Middle East, and the Far East.

Mr. Polmar is a graduate of American University.

Norman Polmar/WORKING PAPER/Revised 7 September 1995

NUCLEAR SUBMARINE DESIGNS

(Year completion of lead ship)

United States	*Soviet Union-Russia*
1955-1960	
1 SSN NAUTILUS	12 SSN November
1 SSN SEAWOLF	1 SSN Mod. November (#645)
4 SSN SKATE	8 SSBN Hotel
6 SSN SKIPJACK	5 SSGN Echo I
5 SSBN GEO. WASHINGTON	
1 SSGN HALIBUT	
1 SSRN TRITON	
1961-1970	
14 SSN THRESHER	7 SSN Alfa
1 SSN TULLIBEE	16 SSN Victor I
37 SSN STURGEON	29 SSGN Echo II
1 SSN NARWHAL	12 SSGN Charlie I
5 SSBN ETHAN ALLEN	34 SSBN Yankee
19 SSBN LAFAYETTE	
12 SSBN BENJ. FRANKLIN	
1 SSXN NR-1	
1971-1980	
1 SSN LIPSCOMB	7 SSN Victor II
39 SSN LOS ANGELES	26 SSN Victor III
	1 SSGN Papa
	6 SSGN Charlie II
	18 SSBN Delta I
	4 SSBN Delta II
	14 SSBN Delta III

1981-1990

18 SSBN OHIO
23 SSN Improved LOS ANGELES

2 SSN Sierra I
2 SSN Sierra II
1 SSN Mike
6? SSN Akula
2 SSGN Oscar I
9+ SSGN Oscar II
7 SSBN Delta IV
6 SSBN Typhoon
1 SSXN X-Ray
2+ SSXN Uniform
2 SSXN Pultas

1991-2000

2+? SSN SEAWOLF

6? SSN Improved Akula
1+ SSN Akula II
1+ SSN SEVERODVINSK

(Total 208)

(Total approx. 250)

NOTES

SSN = torpedo attack submarine
SSBN = ballistic missile submarine
SSGN = guided (cruise) missile submarine
SSRN = radar picket submarine
SSXN = research/special purpose

Major submarine conversions are not included (e.g., Yankee SSGN variants, Yankee SSN, Yankee SSXN).

NON-NUCLEAR SUBMARINE DESIGNS

(Year completion of lead ship)

United States			*Soviet Union-Russia*		
1950-1960					
6	SS	TANG	236	SS	Whiskey
1	SS	DARTER	21	SS	Zulu
3	SS	BARBEL	30	SSC	Quebec
3	SSK	K-1	20	SS	Romeo
2	SSG	GRAYBACK	48	SS	Foxtrot
2	SSR	SAILFISH	6	SSB	Zulu
1	AGSS	ALBACORE	23	SSB	Golf
2	SST	T-1	1	SSX	Whale
1961-1970					
1	AGSS	DOLPHIN	16	SSG	Juliett
			4	SST	Bravo
1971-1980					
(none)			18?	SS	Tango
			1	SSX	Lima
			2	SSX	India
1981-1990					
(none)			25+	SS	Kilo
			1	SSX	Beluga
(*Total 21*)			(*Total approx. 450*)		

NOTES

SS = torpedo attack submarine
SSB = ballistic missile submarine
SSC = coastal submarine
SSG = guided (cruise) missile submarine
SSR = radar picket submarine
SST = training/target submarine
SSX = research/special purpose

Major submarine conversions are not included (e.g., three Whiskey SSG and one Whiskey SSB conversions).

Mr. HUNTER. Dr. Wood, another member of the Aspin submarine panel, thank you for being with us today and for all the contributions you have made to the United States. Please proceed.

STATEMENT OF LOWELL WOOD, VISITING FELLOW, HOOVER INSTITUTION, STANFORD UNIVERSITY

Mr. WOOD. Thank you, Mr. Chairman. I certainly appreciate the subcommittee's invitation to appear and testify today on undersea warfare with focus on the Navy's attack submarine program. Undersea force structure and its possible uses go directly to the heart of American national security, for we are basically an island nation, separated from the large majority of our trading partners and from most of the areas which most concern us in foreign affairs by large oceans.

With the notable exception of transport of people, we continue to communicate transoceanically almost exclusively by ship in both peacetime and wartime. Indeed, in the two great World Wars of this century, submarine and antisubmarine warfare were pivotal areas of conflict. Thus, both geography and history inform us that the ability to employ military force successfully at all levels of intensity in the undersea environment arguably is more important to the United States than it is to any other great power.

Though we seldom reflect on it much, the American Navy effectively controls the world ocean today. Its present margin of superiority in the Earth's maritime environment is sufficiently great as to aptly merit the designation of naval supremacy. Our great aircraft carrier-centered fleets and task forces guarantee freedom of the high seas to all countries for innocent passage, augmented crucially by our space-borne, maritime-directed national assets and by our undersea fleet of nuclear powered attack submarines.

In addition to their crucial roles in defending the surface fleet from attack and in prosecuting offensive operations under water, the attack submarine fleet is the only active defense capability of our ballistic missile launching submarine fleet which to an ever greater extent constitutes the core of our strategic nuclear deterrent. In spite of their modest quantities relative to those of potential adversaries, the Navy's attack submarine fleet dominated the oceans during the cold war, crucially enabled by the fact that we could determine by stunningly long-range acoustic means rather precisely where Soviet submarines were operating, while the Soviets couldn't locate our subs by any really effective means at all.

Due to the synergistic effects of treason by key Americans, theft of advanced Japanese technology, and overall technological advance in the Soviet Union, the Soviets managed to quiet their most advanced submarines down to the level of our best ones just at the end of the cold war, as you have heard from my colleagues Tony Battista and Norman Polmar.

With the collapse of the Soviet Union, the United States quite abruptly discontinued our most advanced line of attack submarines, the *Seawolf* class just as it was getting into production. Only two have been built. The Russians, in contrast, seem to be building both attack and ballistic missile launching subs at rates not greatly less than the cold war peak. The reasons for this aren't altogether clear, although Russian Defense Minister, Pavel

Gravchev, recently remarked to the effect that the Russians and everyone else, he said, had learned from the Americans just how important nuclear powered submarine capability is to any nation which aspires to great power status.

In essence, we Americans are presently trying to figure out where to go from here with respect to attack submarines. Both the international security implications and the economic stakes are huge. For example, as we have just heard, a single *Seawolf* costs quite a bit more than $2 billion, and we plan to build a few dozen of them. The Navy, understandably concerned with maintaining its ability to create attack submarines at all, wants to immediately proceed to build what you might call *Seawolf Light,* a class of attack submarines offering everything the *Seawolf* did but in more modest quantities. They call this the New Attack Submarine. Due to lack of sufficient leadership from other portions of Government, it has been left to the House to come up with a plan which will be militarily rational in a highly uncertain future and which has the requisite long-term domestic political sustainability.

The House proposal, contained in its version of the fiscal 1996 defense authorization bill, embodies the basic features which any plan seemingly must have: First, greatly improved economic efficiency relative to *Seawolf* and to the new attack submarine; two, sharply enhanced technological currency relative to all recent American attack submarines; three, and perhaps most crucial of all, a New Attack Submarine construction plan providing for an absolutely essential technology insertion centered operational prototyping program for genuinely advanced attack subs, and which also maintains the submarine building industrial base.

Very importantly, the House plan doesn't impair near-term, middle-term, or far-term undersea force effectiveness in any way. Indeed, many, including myself, and I believe it is quite clear, my civilian colleagues here this morning would argue that the far-term attack subforce effectiveness contemplated by the House plan is likely to be much greater than with either the current New Attack Submarine Program or the Senate plan.

For all these reasons, I am here today to speak vigorously in favor of the essential features of the House plan for continuing and sustaining American military supremacy in the absolutely vital undersea environment. Unless the basic features of the House plan prevail, our present undersea superiority will vanish during the next decade. It will be replaced not by parity but by both quantitative and qualitative inferiority to the Russian undersea fleet. We will thereafter be tempting on a continuing basis the adventurous and imperialistic streaks in the Russian military and government, whatever it may be a decade or two hence. This is a profoundly troubling prospect.

Thank you very much, Mr. Chairman.

Mr. HUNTER. Dr. Wood, thank you.

[The prepared statement of Mr. Wood follows:]

EMBARGOED UNTIL RELEASED BY THE SUBCOMMITTEE

PREPARED STATEMENT

Supporting Invited Testimony To Be Presented By

Dr. Lowell Wood*

On

Advanced Technology In Undersea Warfare

Before The

Subcommittee on Military Procurement
Committee on National Security
U.S. House of Representatives

10:00 AM, 7 September 1995
2118 Rayburn House Office Building

"I am not certain that there is always progress. There may merely be change."
— William James

Introduction And Caveats. I certainly appreciate the Subcommittee's kind invitation to appear this morning and offer testimony on advanced technology in undersea warfare. I come to this topic as something of a disinterested albeit long-time observer of these matters, having neither present nor recent past nor anticipated future direct, personal involvement in undersea warfare technology development. I had the privilege of serving this Committee a half-dozen years ago as a member of its Advisory Panel On Submarine and Antisubmarine Warfare, convened by then-Chairman Les Aspin to review and report on all aspects of the Navy's undersea warfare posture. I served on this 15-month-long study with such distinguished colleagues as William Perry, Paul Kaminski, and Harold Smith – all currently in Government service – retired admirals Robert Wertheim and Edward Burkhalter, as well as George Heilmeier, Harold Rosenbaum, Harry Jackson and John Foster, the latter being the senior among us on the Advisory Panel, as well as in very many respects among those testifying this morning.

While a disinterested observer, I come to the undersea military domain-of-discourse with several firmly held convictions, which candor obliges me to state clearly and initially:

- I believe that the ability to conduct military operations successfully under the ocean surface, under all circumstances and in all locations against all adversaries, will remain an absolutely essential dimension of America's national security into the foreseeable future, one dictated by the basic nature of armed conflict and the large-scale geography of the Earth itself.

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* Visiting Fellow, Hoover Institution on War, Revolution and Peace, Stanford University, Stanford CA 94305-6010. Opinions expressed herein are those of the author only.

- I believe that the Navy quite aptly discharged its fundamental responsibilities in these respects during the past half-century, developing and maintaining an undersea force structure that was literally peerless.

- I believe that the Navy's basic institutional capabilities equip it to continue excellently to fulfill analogous responsibilities as far into the future as the eye can see, as a most apt steward of the trust – and the tangible resources – which the Congress extends to it annually on behalf of the American people.

- I believe that the present and likely-future American technology base offers the Navy a truly spectacular wealth of opportunities with which to pursue undersea military excellence in all respects during the next few decades.

At the same time, I am not blind to several imperfections in the Nation's present and near-future posture in undersea warfare capabilities and preparations. Indeed, ***these imperfections are so large in scale and so deeply rooted in the Nation's naval institutional structures that they likely will require principled, resolute, sustained Congressional leadership if they are to be removed. If not obviated, these flaws will imperil future National military superiority in the ocean environment – and will completely preclude the prospect of American supremacy at sea.***

Victory Undersea In The Cold War: Costs, Modes And Consequences. Most, if not all, of these imperfections are vestiges of the Navy's successful waging of its portion of the Cold War. In leading and undergirding the half-century confrontation of the Soviet empire by the North Atlantic Alliance, the American nation spent unstintingly of both its National treasure and talent. Sustained readiness to go to either large-scale conventional or strategic war with very little advance notice was the long-standing imperative to the Navy and other Services from the Nation's leaders, and assured achievement of military success under the worst-possible circumstances of war-commencement was understood to be a *sine qua non* – there were no second attempts, no prizes given for second place in the prospective Battle of Earth.

Now it has been observed quite wisely that, while losing a war imposes severe short-term stresses on the defeated nation's military, winning a war often has disastrous long-term impacts on the victorious nation's armed forces. Defeat almost always teaches better lessons of greater long-term value than does victory, though the former are bitter and the latter sweet.

Consider, then, how the Navy's successful conduct of the undersea portion of the Cold War has instructed and positioned it for "waging the peace" of the next few decades, along each of several major axes of undersea operations.

Costs. The Navy built attack submarines in large quantities during World War II at a present-time cost of roughly $30 M. During the Cold War, this cost escalated to *Seawolf* levels of more than $2000 M (when all costs are included), a increase of more than sixty-fold. The gains in capability of a single attack submarine over the last half-century are enormous, to be sure – but so are those of aircraft carriers. The Navy bought aircraft carriers in quantity during World

War II for roughly $800 M in 1995 dollars – and pays about $4000 M today, a cost-growth of only five-fold.

Something peculiar happened as 25 submarines per carrier in 1945 turned into only 2 submarines per carrier in 1995. There is no satisfactory overall rationalization of this peculiarity known to me – and I've read and listened to lots of attempts. I'm afraid that the truly fabulous capabilities of modern U.S. submarines bewitched senior Navy officers and public officials alike into believing that they must be worth whatever the Navy paid for them – and there was always enough money available in relatively large Cold War military budgets to do pay whatever the presented bill might be. Congressional willingness – indeed, occasional determination – to continue to expand industrial payrolls in submarine-building districts and states undeniably contributed to this overall cost-bloat, and to corresponding aggregate efficiency losses. Now, as National inclination to maintain Cold War military expenditure levels continues to shrivel, the "Excellence At Any Cost" piper is demanding to be paid....

Technological Conservatism. The technological base upon which the operational excellence of the undersea Navy has been built and maintained has always impressed me with its fundamentally "classical" character. While it might be overstating the matter somewhat to style American submarine development during the past several decades as "technologically reactionary," it undeniably has lagged analogous Soviet developments by at least one technology generation in some notable areas – and it must be recalled that the Soviets were generally considered to be one to two decades behind Western technology in most respects.

The several reasons for these lags are both good and bad. It is only human to continue to use the technology that served well in the last-generation of any project or product – though the commercial universe is littered with the sun-bleached skeletons of mighty enterprises who did this once too many times. R&D costs can always be curtailed and finite resources devoted to more favored undertakings, if only quite modest advances are needed for the creation of the next generation product – if marketplace competition will allow such scrimping. Short-sighted demands from overseers, both in DoD and on Capitol Hill, for exclusively low-technical-risk programs and utilization of only already-fully-proven technologies can always be used to salve the consciences of those who know better – the more so as they are unlikely to be around to cope with the consequences, a full submarine generation later.

In the event, it was embarrassing to watch the American Navy launching submarines whose hulls were built of the same strength steel as those launched in World War II at the same time as the navy of the supposedly technologically backward Soviet Union was launching subs whose hulls were constructed of titanium. It was humiliating that the Navy learned of key vulnerabilities of its submarines arising largely from technological conservatism only when the Soviets had vigorously exploited these vulnerabilities as their military force-in-being. The gods of war eventually punish severely such technological backwardness – and we Americans were saved from this particular fate only by bearing down on the Soviets with our relatively great wealth. The fall of the Soviet Union is cold comfort, however, when one reflects that aspects of the

American submarine force's long-term technological backwardness – such as some far-too-large signatures while our boats are underway – continue to be exploited by the military force-in-being of potential adversaries.

Moreover, older technology always costs more than newer, when high-performance products are to be created. The economic penalties grow very large as one "pushes the envelope" of attainable performance. Submarines assuredly are no exception to this general rule. The huge cost-growth in real terms of American submarines during the past half-century is due in substantial part to chronic, regrettably pervasive use of venerable technologies to create world-class products. Now that the Cold War is over, the Navy is rather abruptly faced with National unwillingness to continue to buy such expensive submarines – and it is far from certain of its ability to design and build ones of comparable quality which cost much less.

Pervasive-&-Escalating Quality Emphasis. Quality is an "absolute good" in any product, but it assuredly isn't a free one. The Navy is justifiably proud of the extraordinary quality of its submarine force, quality which is manifested in the large majority of significant respects. Moreover, this quality has improved without serious exception through several generations of submarines, up through *Seawolf* (the loss of the *Thresher*, though inexcusable in technological terms, occurred in first-of-its-class sea trials, not with a post-deployment boat that manifested a flaw in an entire class of subs). However, quality will not improve significantly in any salient respect in going from *Seawolf* to the New Attack Submarine, an absolutely fundamental deficiency which is addressed below.

There is much less basis for pride in the efficiency with which this escalating quality has been realized, as noted above. Indeed, the economic efficiency of quality realization has declined steadily over the past several decades. This trend is potentially ruinous, particularly as we look into post-Cold War real resource envelopes, which are imploding as far as the eye can see.

Susceptibility To Adversary Technical and Tactical Innovation. A persistent blemish on the Navy's overall-outstanding undersea record during the Cold War was the unending string of technical and technology-enabled tactical surprises which the Soviet undersea force structure presented from time to time. These tended to compensate to useful degrees for the overall inferiority of the Soviet undersea force; for varying intervals, they tended to "level the playing field" undersea to annoying extents.

The typical Navy response to these Soviet gambits arrived with all deliberate speed – which had no tangible adverse consequences, since we weren't in a shooting war with the Soviets. Until 'fixes' for each such Soviet innovation finally were deployed or field-proven, however, the less daring Navy sub commanders – and the more prudent supervisory admirals – "pulled in the American horns" to extents which may not always have been maximally supportive of National interests.

In the foreseeable post-Cold War future, we are likely to be playing for much smaller stakes in undersea military operations, moreover with regional powers considerably less capable overall than was the Soviet Union in peak form. Such situations likely will be murky in several respects, in addition to operations in littoral waters, however. For instance, undersea assets owned by several nations, some known and others uncertain or unknown, may be in play in the same area at the same time. In any event, the likelihood in any given decade of getting into a "shooting with real bullets" situation during regional crises, probably in brown rather than blue water, is widely perceived to be much greater. Indeed, there have already been some such near- or threatened-incidents during the past several years involving regional powers in the undersea context.

If American fleets are to continue to underwrite and, as necessary, enforce freedom of the high seas in time to come, considerably more nimble responses to technical and tactical innovations on the part of potential adversaries than was demonstrated in the average with the Soviets likely will be required of the Navy – or American boats and sailors will be lost. Current and likely-future undersea circumstances present a very different challenge than did the Cold War.

The New Attack Submarine Program. These, then, are some of the basic, large-scale challenges facing the Navy, as it navigates the transition from the Cold War into whatever a rather uncertain future may bring. The next major step which the Navy proposes to the Nation in undersea force structure is currently called the New Attack Submarine, and was formerly known as the *Centurion* class of attack subs.

An astute observer who had been living on Mars for the past quarter-century might review the present American attack submarine posture, and remark,

> *"Let's see now. Your Navy has about 80 attack submarines currently, and has been instructed to reduce to 50 or less as soon as feasible. Roughly half of your present attack submarines have at least 15 years of full-service-rated life on them, so that they are likely to be serviceable for perhaps another 20 years with post-Cold War reduced deployment schedules. Building a submarine on a reasonably economic schedule is the work of 2 or 3 years, and you probably need to have at least two under construction at any given time, also for reasons of economy, so that a launch-rate of at least one sub per year per shipyard is indicated.*
>
> *You have recently decided that you can't – or, more correctly, don't wish to – afford to build more of the current* Seawolf *class of submarines, of which you've already bought two. Your current government and industrial submarine team have recent experience only in designing and building these unacceptably expensive subs.*
>
> *Your strategy obviously must be to dismiss the unacceptably expensive submarine design and construction outfits, down to the last Navy office and last shipyard, in order to make a definitive break with the past. Your undersea force structure will then live comfortably off of your post-War submarine retirement dividend for about a decade, while you do the planning, design, R&D, prototyping and sea trials of really modern, inexpensive, high-performance submarines – and the re-outfitting of two shipyards to construct these submarines at competition-ensured economical building-rates (rates much greater than that characteristic of* Seawolf*).*

> *Each shipyard will launch 1-2 subs per year, depending on how cost-competitive it is determined to be from time to time, so that building the new class of 40-50 submarines will take 10-15 years, which is economical overall and which corresponds nicely to the planned retirement-rate of your present undersea fleet at the conclusion of its full service life. Right?"*

Now, as already noted, this observer, though astute, has been living on some other planet than our own for the last few decades. Otherwise, he would be well-aware of how sacrosanct the industrial base for any military system is to the numerically modest but politically telling portion of the United States Senate which is elected by it. It thus seems infeasible to start with a fresh sheet of paper with respect to creating a post-Cold War attack submarine force. Instead, it appear necessary to undertake the more difficult task of rather drastically reforming the existing governmental and industrial submarine-creation structures.

Congressional Leadership In Undersea Posture Remediation. Fortunately, the time available – a decade, possibly somewhat more – may well be sufficient, if the Congress is initially determined – and thereafter diligent – in clearly mandating and resolutely insisting upon the requisite fundamental changes. Although it took Moses forty years in the Sinai Desert to purify the Israelites of their stiff-necked and occasionally idolatrous tendencies, the Congress is not only more numerous, but also may have somewhat more potent management tools. It may well be able to do the job of instilling a basically new efficiency- and innovation-focused culture in the Nation's submarine-creating community in a mere ten years. Indeed, the Congress might aptly take a page from Moses's book, the one in which he started leading the Israelites back to the True Way by an unforgettable ordaination of the sons of Levi which presumably also involved leaders of the cult of the Golden Calf: restorative and corrective actions in undersea warfare programs might best commence in the Naval Sea Systems Command, moreover in a Mosaically clear-cut manner.

To be sure, Les Aspin and the Armed Services Committee made a good start on this huge undertaking a half-dozen years ago, when they adopted the basic recommendations of the Advisory Panel led by Johnny Foster and Bill Perry on which I was privileged to serve.

It's not easy to provide a better summary of where we all stood than to quote excepts in sequence from Bill Perry's open-session testimony to the Committee as he presented our findings and the unclassified version of our report:

> *"However, we [the U.S.] have no room for complacency....The important point, however, is that the [newest] Soviet subs are [now] quiet enough to give our anti-submarine warfare system a real problem. It is fair to say that the submarine/anti-submarine warfare game has changed as a result of this introduction....We must now restructure our ASW systems to recognize this new reality....Therefore, the question comes down to what we should be doing during this [5 to 10 year] period, this grace period, you might say....The deficiencies are that we have not yet formulated the new architecture which*

> *would tie together the new sensors as they are developed, nor have we begun a vigorous program on what I would call the back-end of the R&D effort –picking up the ideas that have been developed, putting them into prototype form and testing them at sea....We sense a reluctance, an understandable reluctance, to commit the resources necessary to enter this new phase in the ASW program. We believe that the importance of fielding this next generation ASW system is so important that it should be given the priority which would allow it to have increases in budget, even in the face of a declining defense budget."*

Unfortunately, Washington is the town where the important is routinely crowded out by the urgent, so that neither the Aspin Pentagon nor the Perry Pentagon nor the Kaminski Acquisition Undersecretariat – or the Cheney Pentagon before them – have yet to implement from the Executive side these unanimous, reasonably urgent Panel recommendations, for which I expect are altogether good-and-sufficient reasons-of-urgency which likely range from BUR through Somalia and BRACs on to Bosnia. Six-and-a-half years of the "5 to 10 years of grace" to which Bill Perry referred to then have now elapsed, and virtually none of the corrective steps of which he then spoke so eloquently and urgently has yet taken place.

Consequences Of Failure Of Leadership. Even benign and well-intentioned neglect sometimes has most unfortunate consequences. ***The long-term adverse trends in undersea warfare about which the Advisory Panel warned in its March 1989 report to this Committee have not only continued but accelerated.*** For instance, ***the Navy has not had a long-term ASW Master Plan for the past several years, overall ASW R&D expenditures have plummeted by a factor-of-three since we of the Advisory Panel recommended real increases to you, and – very tellingly – the Russian attack submarines presently being launched are certainly less detectable and arguably more combat-survivable overall than many of those which comprise our undersea fleet.***

The Center for Naval Analyses' Robert Murray, writing perceptively in the August 25, 1995 Wall Street Journal, noted that, while the Soviet Union has vanished, the Russian submarine-building program is alive, well and essentially undiminished from its Soviet heyday, a fundamental anomaly in the general wasteland of present-day Russian military procurement. By way of explanation, he quotes a statement which the **Russian Defense Minister, General Pavel Grachev** (a Red Army paratrooper by professional background), made last year:

> **"A nuclear submarine fleet is the future of the armed forces. The number of tanks and guns will be reduced, as well as the infantry, but a modern navy is a totally different thing. The governments of all developed countries understand this very well."**

Meanwhile, our attack submarine construction effort has faltered for lack of politicoeconomic sustainability, and the Navy, after at least 3 years of effort, has been unable to generate an alternative which can command a stable base of bicameral Congressional support. ***These trends, if continued, will be disastrous for American national security, for they will involve probable loss of America's superiority at sea.***

The Way Out Of The Morass. The only credible avenue out of this ever less tenable situation is that outlined by the House version of the FY96 Defense Authorization. The House has specified a national priority submarine program that would preserve our industrial base and work toward developing a highly capable and affordable submarine for the twenty first century through the use of operational prototypes. Very importantly, in the associated report language, the House specified that all major sources of American military technology, including the ARPA-funded community and the DoE National Laboratories, should become major contributors to this technology insertion and qualification program. (A few -- but by no means all -- aspects of the existing attack submarine technology effort have given inbreeding an undeservedly bad name, to phrase it delicately.) In this connection, it may well be appropriate for the Congress to explicitly encourage the Navy to study, close-up and without preconceptions, the notable attack submarine and ASW technology accomplishments of our NATO Allies -- and, to the greatest feasible extents, those of our former adversary, the Russian Federation. Economic efficiency increases and acoustic signature decreases are only two salient examples of areas in which we have something to learn from others.

***Only* when the Navy has demonstrated its ability to innovatively design and economically construct technically modern attack submarines via this prototyping program should we actually start laying down keels for our next generation submarine.**

Political realism compels explicit mention that this prototyping program implicitly will "preserve the attack submarine industrial base" -- i.e., keep something approximating present levels of Federal payroll funds flowing to Navy and industrial organizations in favored Congressional districts and States -- for these will very likely be re-tooled by the Navy into the executing agents for the prototyping program. *If efficiently* employed, this already-extensive base can support both rapid and extensive technology insertion and prototyping.

It is crucial that senior Navy leadership, civilian and military, actually diligently oversee the required re-tooling of the existing base, for it assuredly will not occur spontaneously. The Navy, at least as much as other Services, is possessed of full measures of the cardinal military virtues of steadfastness in the face of adversity and perseverance in pursuit of mission goals. It is therefore essential for the Navy to perceive the recommended Congressional action not as adversity to its undersea capabilities or obstruction of its maritime military mission, but as a challenge of historic magnitude to adapt its undersea force structure to the constraints and opportunities of the post-Cold War era, coming from those uniquely and specifically charged by the Constitution "to provide and maintain a Navy." In this light, I **respectfully suggest that it will be necessary for this action to be statutory in nature and that it would be appropriate for it to be given the character of an enduring National policy determination, e.g., "the Attack Submarine And ASW Program Act of 1995."**

In the spirit of comity between the Executive and Legislative Branches, the Congress might aptly take explicit action this year to provide a statutory foundation upon which the Secretary of Defense may readily implement the concluding recommendation in the Executive Summary of the Advisory Panel Report:

"...we recommend that the Secretary of Defense appoint a broadly based standing committee of recognized experts in the relevant disciplines to advise him on the subject of ASW, including
- *The evolution of the submarine threat;*
- *Objectives, strategy, plans, and programs to deal with that threat;*
- *The adequacy of U.S. programs, management, and resources;*
- *The quality of U.S. research;*
- *The adequacy of coordination among the organizations involved; and*
- *Desirable actions and initiatives."*

The responsible committees of the Congress, perhaps as a joint action, perhaps would do well to create a similar standing advisory committee, in order to assist them in engaging DoD and Navy leadership on this issues as a full-and-equal partner and to advise on legislative steps to be taken annually to assure success of the recommended decade-duration prototyping and technology upgrading program.

Conclusion. ***It seems essential to America's long-term national security that the House insist upon its better-founded program plan in the upcoming Defense Authorization Conference, that the Congress thereby legislate and thus mandate to the Navy an undersea warfare master plan very similar to that contained in the House defense authorization bill , and – perhaps most crucially of all – that the House remain closely engaged with this issue during the coming decade.*** During this time, Defense Secretaries and Acquisition Undersecretaries all will continue to come and to go and the Congress and the Navy each will continue to remain, so that if the recommended fundamental changes in undersea force structure creation are to indeed occur, the Congress must remain engaged.

Otherwise, on the attack submarine portions of the undersea warfare front, ***change assuredly will take place, but there will be essentially no progress*** – and the American Nation will be much the poorer for it.

I thank the Committee once again for the invitation to appear this morning and, very particularly, for its most heartening renewal of interest in this absolutely vital matter. I remain grateful for both past and present opportunities to be of some service to the Nation's security.

Mr. HUNTER. Mr. O'Rourke has been our in-house submarine expert, attended many of our hearings in marathon style for the CRS [Congressional Research Service], and Ron, thank you for being with us. You understand, Mr. O'Rourke, the essentials of the House plan, and the elaboration of that plan on the conference for position at conference, and I wonder if you might just take a minute or two to describe the prototyping that we envision, and there have been some statements from the Navy to the effect that cost would be in multiples of billions per platform, and I know you had yesterday a response to that.

Could you briefly describe that plan with respect to cost?

STATEMENT OF RON O'ROURKE, IN-HOUSE SUBMARINE EXPERT

Mr. O'ROURKE. Yes, I would be happy to. Thank you for the opportunity to appear here this morning. As you know, I have provided some technical support to the subcommittee in developing options relating to submarine acquisition, and it is in that capacity that I appear before you this morning.

You just asked me to provide a brief explanation of the proposal developed by the subcommittee to replace the administration's plan to build new attack submarines with a plan to build instead several operational prototype submarines followed by series production of a next generation design.

The following is a brief outline of the proposal. To begin, the primary aim of the proposal is to achieve in a relatively short period of time a design for a next-generation submarine that will be more capable than the New Attack Submarine design and thus better able to counter future Russian fourth and fifth generation submarines expected to enter service around the same time.

The proposed plan has three key elements. First, the plan maintains the active involvement of both Electric Boat and Newport News in submarine design and construction so that competition between the two shipyards can be used to foster technological innovation.

Second, the plan includes additional funding for accelerated development of advanced submarine technologies so that these technologies can be made available sooner. And third, the plan involves building multiple operational prototype submarines as a means of breaking through the limits of the current weapon acquisition system, which is often described as a risk-averse system.

The operational prototype submarines that would be built under the plan would be fully operational boats, not just R&D boats. As fully operational boats, they would contribute to the Navy's warfighting force structure and respond to the Navy's stated near-term need for operational *Seawolf* level stealthy submarines.

The first such operational prototype which would be funded in fiscal 1998 would be the Navy's current New Attack Submarine design or something very close to it, but instead of being built as the first boat in a series production class as under the administration's plan, this boat would be the first in a series of operational prototypes.

Each subsequent operational prototype in the series would incorporate a different package of advanced technologies, and the result would be a group of sibling submarines, submarines that would be very similar to one another and to the baseline New Attack Submarine design except for the differing packages of advanced technologies that they each incorporated.

The administration's plan would periodically inject new technologies into the New Attack Submarine design as procurement of the New Attack Submarine proceeded. The plan to build operational prototype submarines differs conceptually from the administration's plan in four respects.

First, the new technologies would be injected into the baseline New Attack Submarine design sooner under the subcommittee's plan than under the administration's plan.

Second, the technology packages injected into the design would be larger in scope than those to be injected under the administration's plan.

Third, the technology packages would be more experimental and developmental in nature than under the administration's plan. And fourth, the operational prototypes would be followed by series production of a new next-generation submarine as opposed to continued production of the New Attack Submarine design under the administration's plan. The aim in building these operational prototypes would be to provide boats for rapid at-sea testing and validation of advanced submarine technologies that cannot be adequately tested and validated on existing submarines and which would be too high a risk to incorporate without prior at-sea testing into a design meant for serious production.

The advanced technologies that could be involved in the plan include, but are not necessarily limited to the following: First, more extensive or aggressive use compared to the Navy's plan of the following technologies: Automation that permits crew reduction while satisfying requirements for watch-standing and damage control; fiber optics; advanced alloys and composite materials; active quieting and shock protection; launch tubes and other systems located external to the pressure hull.

Again, the Navy is doing these things, but the subcommittee's plan would make more extensive or agressive use of these technologies. Other technologies that could be involved include electric drive machinery plant, advanced hydrodynamics, including passive and active drag reduction and microelectrical mechanical systems.

Under the proposed plan, the operational prototype submarines would be built under a more streamlined acquisition process that is aimed at lowering acquisition costs and shortening the acquisition cycle by taking better advantage of commercial off-the-shelf technologies, particularly in the area of electronics.

This plan focuses not on the so-called bridge issue, which is the issue of how to maintain the submarine industrial base between now and fiscal year 1998, but rather on the subsequent issue of what is at the other end of the bridge. In other words, the plan focuses not on the issue of whether to build the third *Seawolf* or whether the second or third *Seawolf* should be built to a long hull, expanded-capability configuration. It focuses instead on what comes after that, in the period fiscal 1998 through 2003. The plan would fund the construction of four or five operational prototype submarines in the 5-year period, fiscal 1998 through 2002.

In the case of five operational prototypes, one boat would be funded in each of those 5 years. The first, third, and fifth operational prototypes would be built by Electric Boat, while the second and fourth would be built by Newport News. Technologies tested and validated in these boats would be incorporated into a next-generation submarine design that would begin series procurement in fiscal 2003.

The plan proposes building four or five operational prototypes rather than just two or three for two reasons. First, two or three boats would not be enough to maintain the active involvement of both Electric Boat and Newport News in submarine design and construction between now and fiscal 2003.

Second, concentrating the advanced technologies that are being contemplated into two or three prototypes would increase the technical burden shouldered by each of those boats.

As you mentioned, I was asked to provide a rough cost estimate of the additional costs of this plan relative to the administration's baseline. That is, the additional costs that would be incurred above what the Navy has already programmed in this area.

I estimated that for the 8-year period of fiscal 1996 through 2003, the cumulative additional costs of this plan in the case of five operational prototypes would be roughly $6 to $8 billion in constant fiscal 1996 dollars. Using the higher $8 billion figure, this works out to an average additional cost above the Navy's plan of roughly $1 billion per year for the 8-year period.

This $8 billion figure breaks down approximately as follows: First, a total of $1.6 billion, an average of $200 million per year would be for research and development work on advanced submarine technologies above what the administration has already programmed. Second, about $1 billion would be for detailed design work on operational prototypes in addition to the funds that the administration has already programmed for detailed design of the baseline New Attack Submarine.

Third, about $3.3 billion would be for the portion of the development and detailed design work on the next-generation submarine that would be captured through fiscal 2003, and finally about $2 billion would be for the additional submarine construction costs of the operational prototypes compared to building new attack submarines due to reduced learning between boats and splitting the learning curve between two yards. I should emphasize again that these are rough cost estimates based on the information that we had available.

In summary, the additional estimated costs above the Navy's plan of roughly $1 billion per year is aimed at accomplishing the following: First, it is aimed at maintaining the continued active involvement of both Electric Boat and Newport News in submarine design and construction rather than Electric Boat only which is a possible outcome of the administration's plan.

Second, it would fund six operational submarines in the period fiscal years 1998–2003. That is the same number that would be funded under the administration's plan.

Third, the subcommittee's plan is aimed at developing advanced submarine technologies more quickly than under the administration's plan.

Fourth, it is aimed at providing platforms that the Navy can use for rapid at-sea testing and validation of these technologies. And fifth, it is aimed at laying the foundation for procurement of a next generation boat starting in fiscal year 2003 rather than continuing procurement of the New Attack Submarine for possibly many years after fiscal 2003 as under the administration's plan.

Mr. Chairman, this concludes my presentation. I will be happy to respond to any questions you might have.

Mr. HUNTER. Mr. O'Rourke, thank you for a very succinct, very clear description of the committee's position, and our conference elaboration of that position, and now I would like to ask Admiral Jones, Admiral Frick, thank you for being here, and Admiral Jones, are you ready to lead off?

Admiral JONES. Yes, sir.

Mr. HUNTER. You have heard the House position. You have heard the positions of two members of the Aspin blue ribbon submarine committee. You have heard from Mr. Battista and Mr. Polmar. Please proceed as you wish and tell us why you like this New Attack Submarine and you like the present Navy course better than what has been suggested.

STATEMENT OF REAR ADM. DENNIS A. JONES, USN DIRECTOR, SUBMARINE WARFARE DIVISION (N87) ACCOMPANIED BY REAR ADM. ROBERT E. FRICK, USN, PROGRAM EXECUTIVE OFFICER (SUBMARINE)

Admiral JONES. Yes, sir, thank you. Mr. Chairman, distinguished members of the subcommittee, I really appreciate this opportunity. My job is the Director of Submarine Warfare on the Chief of Naval Operations staff.

As such, my job really entails setting the submarine force requirements. I have Adm. Bob Frick with me. He has a brief statement also, but he is the program executive officer, and he is responsible for execution of submarine procurement. We do have a written statement, sir, that we would like to submit.

Mr. HUNTER. Without objection.

Admiral JONES. But I do have a very short comment. Sir, the Navy's plan for the New Attack Submarine Program from the very start has been to develop a multimission submarine that achieves four goals. The first goal is to build a submarine that is more capable than its predecessors for operations in the littoral.

The second goal was to build a submarine that maintains United States undersea superiority against continuing Russian submarine development and construction efforts. Third, it was to build a submarine that contains major new technologies and contains the ability to flexibly incorporate new technologies that may come along in the future. Fourth, to build a submarine that is affordable.

The New Attack Submarine meets all of these goals. It will do everything that we, the operators, need to do. As the submarine warfare community sponsor, my office has been intimately involved in the selection of technologies and attributes that have shaped this new design. At each step, we have worked to make sure that the commanding officer and the crew of these new submarines is going to be able to go to sea with the best advances in technology, technology that will make their ship a better war-fighting platform.

Sir, I would just like to tell you that having personally commanded a nuclear submarine at sea, I consider it a personal responsibility to ensure that this happens. I can state emphatically and will state emphatically that I am satisfied, ultra-satisfied with the present design efforts. It is my opinion that the Navy is designing the right submarine for the future of this country.

Now, as you have heard in previous testimony this year, sir, the New Attack Submarine also plays a pivotal role in the Navy's recapitalization plan. By the year 2011, and that is not very far away, 688 class submarines will start to reach the end of their service lives that are rated three to four years. We need to achieve a low but continuous and efficient submarine production rate by the year 2002 in order to sustain even reduced fast attack force levels.

To accomplish this we must start building the new class of submarine in 1998. Reaching a low but achievable production rate by the turn of the century will satisfy very valid military requirements. It will sustain our ability to build submarines affordably and is the foundation for which will allow us to bring new technology into the submarine force. Mr. Chairman, that concludes my comments.

Admiral Frick is ready to proceed with his statement, sir.

Mr. HUNTER. Admiral.

STATEMENT OF REAR ADM. ROBERT E. FRICK, PROGRAM EXECUTIVE OFFICER, SUBMARINES, OFFICE OF THE ASSISTANT SECRETARY OF THE NAVY, RESEARCH, DEVELOPMENT, AND ACQUISITION

Admiral FRICK. Good morning, Mr. Chairman. Thank you for inviting me to testify. We provided a written statement and a classified written statement to your staff, and I think those two statements set a good technical baseline for what the New Attack Submarine Program has in it, and I would offer that that is a good reference that sets forth the technology and the technology refreshment for that program.

Let me begin by stating that I fully understand and support the committee's desire to ensure that the new attack submarine has the capability to meet the world threat and the flexibility to exploit advances in technology as they become available. The challenge I face as the program executive officer responsible for overseeing the acquisition of a new attack program is finding the right balance between the advanced technology and affordability in meeting the requirement to deliver a capable and affordable submarine.

The Navy has conducted a thorough examination of cutting-edge technologies, incorporated those technologies where they were sufficiently mature and would provide the operational effectiveness of the ship, improve reliability, comply with the environmental statutes or reduce costs. Our search sought ideas from beyond the submarine community's perspective. The Navy involved respected engineers and scientists from Government laboratories and the private sector in this technology review effort.

The Navy will continue to identify and assess diverse technologies from both the military and commercial sectors. Private industry, the Advanced Research Projects Agency [ARPA], Navy and national laboratories, and other U.S. military services have been and will continue to be involved in research and development initiatives and technologies that make the best sense for incorporation in the New Attack Submarine.

Cooperation with national intelligence agencies is ongoing to ensure that the Navy has a comprehensive understanding of the nature and capabilities of the threats our submarines and all our naval forces will face in the next century. Among the major breakthroughs in the design of a new attack submarine is its open electronic system architecture and modular hull design. Both of these items allow for rapid, cost-effective insertion of new technology throughout the life cycle of the ship, and that is a basic fundamental for the New Attack Submarine.

The New Attack Submarine has completely embraced the design-build approach as a cornerstone of affordability and future technology assertion. As part of this approach, we have formed integrated product teams with membership from the Navy, key component suppliers, designers and shipbuilder trades people to drive costs down by making prudent early decisions on ship design.

Additionally, the New Attack Submarine design process is employing the latest developments in computer-aided design, engineering, and manufacturing. Our approach maintains the submarine's design in a single database from which design products such as drawings, material procurements and work packages are generated.

The availability of the single three dimensional product model permits the quick integration of new technology in a New Attack Submarine design. It also allows rapid evaluation of the technical feasibility and shipboard implications of inserting different technologies into the ship well before committing any actual design or redesign, a significant time and cost reduction measure.

Examples of technologies the Navy is using in New Attack Submarine and there are many in the written report, the open system architecture, which I have discussed for the command and control system, widely available commercially-based standards and well-defined system interfaces are the foundation of the technical approach.

This approach will maximize portability and reuse of software with future technology upgrades at minimum costs and, in fact, the contractor will be required to refresh this to up-to-date technology the day or the year the ship is delivered. The New Attack Submarine is making extensive use of leading-edge commercial off-the-shelf electronics, allowing the Navy to leverage exponential growth in signal and information processing and display technologies occurring in industry greatly simplifying future technology upgrades.

Structurally integrated enclosures are being incorporated in the ship to provide standard electronic mounting interfaces embedded with ships deck structure to facilitate cost-effective replacement of advanced technology, electronic components without requiring major space rearrangements. The ship will utilize an isolated deck structure which is tuned to provide optimum noise isolation through the use of advanced computerized structural design tools.

This approach facilitates the equipment integration, provides shock and acoustic isolation sufficient to allow the on-board use of commercial off-the-shelf technology and provides a configuration which allows the insertion of active noise control technologies as they are developed and matured.

Traditional periscopes are being replaced with state-of-the-art imaging which provides near all weather and night vision by using the latest commercial and government off-the-shelf technology. The imaging sensors are all mounted in nonpenetrating mass, thus eliminating periscope hull penetrations and periscope wells. This is a major breakthrough in submarine design, providing the maximum flexibility in arrangements. The incorporation of the universal modular mast improves maintainability and provides a quick configurable mission-specific mass location.

This will provide the flexibility for cost-effective application of evolving antenna and sensor technology such as the super high frequency communications technology. The New Attack Submarine will have a reconfigurable weapons handling and stowage system or a module which provides 24 weapons stows, satisfies reload requirements, shock and acoustic specifications and provides 2,400 cubic feet of reconfigurable space. This reconfigurable space is a key feature of the New Attack Submarine which provides substantial mission flexibility.

Since 1988 the Navy has worked closely with ARPA to develop new submarine technologies. These technologies have been assessed and where appropriate used in the New Attack Submarine Program based on merit and risk, and once again, I will refer to the written statement that contains the details of that.

Examples of those technologies being used in the New Attack Submarine include electron magnetic signature reduction, which Dr. Foster explained was very important, magnetic bearings and nonpenetrating periscope. The exact status of that technology is in my written statement.

In summary, the Navy has considered a wide spectrum of technology initiatives for New Attack Submarine. Those technologies that show promise and are projected to reach maturity at a time consistent with the New Attack Submarine design-built process have been incorporated. There are no new technologies on the horizon that warrant delay of the New Attack Submarine.

The New Attack Submarine class will be the most flexible generation of submarines ever designed. The design will be open for the infusion of technologies that reach maturity subsequent to initial production. The Navy's approach to the design of New Attack Submarine ensures our ability to accommodate changes in mission requirements in the future threat. The fundamental program objective remains to regain and improve our margin of undersea superiority at an affordable cost.

Mr. Chairman, that concludes my statement subject to your questions.

[The prepared statement of Admirals Jones and Frick follows:]

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PROCUREMENT SUBCOMMITTEE

STATEMENT OF

REAR ADMIRAL DENNIS A. JONES, USN
DIRECTOR, SUBMARINE WARFARE DIVISION (N87)

AND

REAR ADMIRAL ROBERT E. FRICK, USN
PROGRAM EXECUTIVE OFFICER (SUBMARINES)

BEFORE THE

SUBCOMMITTEE ON PROCUREMENT

OF THE

HOUSE NATIONAL SECURITY COMMITTEE

ON THE

APPLICATION OF ADVANCED TECHNOLOGY TO
THE NEW ATTACK SUBMARINE

SEPTEMBER 7, 1995

NOT FOR PUBLICATION UNTIL RELEASED BY THE
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REAR ADMIRAL DENNIS A. JONES
UNITED STATES NAVY

DIRECTOR, SUBMARINE WARFARE DIVISION (N87)

Rear Admiral Dennis A. Jones is a native of Fairbury, Nebraska. After attending one year at Fairbury Junior College and one year at the University of Nebraska, he entered the United States Naval Academy and was graduated and commissioned in 1965. Following graduation from the Naval Academy, Admiral Jones attended Nuclear Power School in Mare Island, California, and nuclear prototype training in Idaho. After completion of submarine school in Groton, Connecticut, he reported to the precommissioning crew of USS HAMMERHEAD (SSN 663). In 1970, Admiral Jones reported to USS HENRY L. STIMSON (SSBN 655) as Engineer Officer. In 1974 he reported to the staff of Commander in Chief, U.S. Atlantic Fleet where he served as a member of the Nuclear Propulsion Examining Board. From 1976 to 1979 he served as Executive Officer of USS SPADEFISH (SSN 668). In 1979 he reported to the Staff of the Chief of Naval Operations in Washington, D.C. where he served as the first Nuclear Officer Programs Manager.

Admiral Jones served as Commanding Officer of the nuclear attack submarine USS BIRMINGHAM (SSN 695) from 1981-1984. The ship was twice awarded the Meritorious Unit Commendation and twice the Battle Efficiency "E" Award for operations during that period.

In April 1984, Admiral Jones assumed the duties of Special Assistant to the Deputy Assistant Secretary for Naval Reactors, Department of Energy in Washington, D.C. Admiral Jones then served as Commander Submarine Development Squadron TWELVE in Groton, Connecticut, from June 1987 to March 1989.

Admiral Jones served as the Command and Control Division Chief (J3) on the Joint Staff from April 1989 to April 1990. He then assumed the position of Director of Special Programs in the office of the Under Secretary of Defense for Acquisition. He commanded Submarine Group EIGHT and Allied Submarines Mediterranean from September 1992 until July 1994. He assumed his current duties as Director, Submarine Warfare Division (N87) in September 1994.

Admiral Jones attended Harvard University in the program for Senior Executives in National and International Security. His decorations include the Defense Distinguished Service Medal with bronze oak leaf cluster, the Legion of Merit with two gold stars, two awards of the Meritorious Service Medal, the Navy Commendation medal, and three awards of the Meritorious Unit Commendation. He is married to the former Eileen Betty Spensky of Weirton, West Virginia. Admiral Jones has five children, Kirkland, Derrick, Samantha, Ashley and Kellen.

Rear Admiral Robert E. Frick
Program Executive Officer, Submarines

Rear Admiral Frick is a native of Erie, Pennsylvania. He enlisted as a seaman in the U.S. Navy in 1961. After completing basic training, he was assigned to USS SABALO (SS 302) in Pearl Harbor, Hawaii where he completed his initial qualification in submarines earning his silver dolphins in February 1963.

Rear Admiral Frick was then selected for and completed enlisted nuclear propulsion training in 1964. His performance further resulted in his selection to attend Purdue University under the Navy Enlisted Scientific Education Program. He graduated from Purdue University in 1969 with both Bachelor and Master of Science Degrees in Mechanical Engineering. Commissioned as an Ensign in June 1969, he completed Nuclear Propulsion Officer Training and reported as a division officer aboard USS WILL ROGERS (SSBN 659) where he earned his gold dolphins in December of 1971. His assignment included non-nuclear systems coordinator during an eighteen-month conversion and refueling overhaul at Portsmouth Naval Shipyard. Rear Admiral Frick next served as Engineer Officer on USS HADDOCK (SSN 621) through a fifteen-month refueling and combat systems conversion overhaul at Mare Island Naval Shipyard. He served as Executive Officer on USS DRUM (SSN 677) and on USS KAMEHAMEHA (SSBN 642) during a strategic weapons conversion overhaul at Portsmouth Naval Shipyard.

From April 1984 until October 1987, Rear Admiral Frick served as Commanding Officer, USS BIRMINGHAM (SSN 695), an assignment which included the ship's first major overhaul at Pearl Harbor Naval Shipyard.

Following Command, Rear Admiral Frick served as the Deputy Commander for Submarine Squadron One in Pearl Harbor and as Senior Member of the CINCPACFLT Nuclear Propulsion Examining Board. In 1990 Rear Admiral Frick elected transition to the Material Professional Program with assignment as the Assistant Program Manager for Attack Submarines responsible for SSN 688 class new construction efforts. In July 1992, he was assigned as the Senior Military Assistant to the Under Secretary of Defense for Acquisition and Technology. In August of 1993, he reported to Naval Sea Systems Command and assumed the duties as the Deputy Commander for Submarines.

Rear Admiral Frick currently serves as Program Executive Officer, Submarines. His decorations include the Defense Superior Service Medal, the Legion of Merit, the Meritorious Service Medal with four gold stars and the Navy Commendation Medal with two gold stars. He is married to the former Susan Marie Mitchell of Erie Pennsylvania. They reside in Burke, Virginia with their three children, Jennifer, Sarah and Kevin.

STATEMENT OF RADM DENNIS A. JONES AND RADM ROBERT E. FRICK

"APPLICATION OF ADVANCED TECHNOLOGY - NEW ATTACK SUBMARINE"

Mr. Chairman, distinguished members of the Committee: I greatly appreciate this opportunity to appear before you to discuss the Navy's programs for ensuring that the most technically capable and affordable advanced technologies are included in the New Attack Submarine.

My testimony today will discuss these points:

- The requirement for the New Attack Submarine to achieve a balance between technology and affordability;

- How the revolutionary design/build process for the New Attack Submarine supports technology insertion throughout the life of the class;

- The advanced technologies that have been incorporated into the New Attack Submarine; and

- An overview of the transition of Advanced Research Projects Agency technologies to the New Attack Submarine.

Achieving a Balance – Technology versus Affordability

Let me begin by stating I fully understand and support the Committee's desire to ensure the New Attack Submarine has unequaled capability to evolve to meet changes in mission requirements and the world threat and to exploit advances in technology as they become available.

The challenge I face as the Program Executive Officer responsible for overseeing the New Attack Submarine design and construction program is finding the right **balance** between advanced technology and affordability in meeting the requirement to deliver a capable alternative to the SEAWOLF-class submarine.

We conducted a thorough examination of "cutting-edge" technologies and incorporated those that were sufficiently mature and would improve the operational effectiveness of the ship, improve reliability, comply with environmental statutes, or reduce cost. The Navy involved respected engineers and scientists beyond the submarine community in the technology review effort. Multiple independent reviews have concluded the New Attack Submarine has the right balance between advanced technology and affordability and that there are no new technologies on the horizon that warrant delay of the program.

We have taken great care to guarantee that the New Attack Submarine has been "tailored" for the 21st-century Joint Littoral Operations envisioned in the Navy Department's *...From the Sea* and *Forward ...From the Sea* strategic concepts.

Innovative design/build processes and designing for modular construction will enable us to insert advances in technologies to counter future threats.

We will continue to identify and assess diverse technologies from both the military and commercial sectors. Private industry, the Advanced Research Projects Agency, Navy and national laboratories, and other U.S. military services have been, and will continue to be, canvassed for research and development initiatives and technologies that make best sense for early and follow-on New Attack Submarines.

We are working with Navy and National intelligence agencies to ensure we have a comprehensive understanding of the nature and capabilities of the threats our submarines, and all our naval forces, will face in the next century.

The New Attack Submarine program objective is straightforward -- build a capable, affordable submarine that has SEAWOLF-level quieting and makes the best use of advanced technology.

The balance of my statement will focus on how we are achieving this program objective.

Technology Onboard the New Attack Submarine

As part of the Milestone I decision process for the New Attack Submarine, the Under Secretary of Defense (A&T) chartered an Independent Review Group to examine the submarine's design. The review group concluded: "There are no emerging technologies on the horizon that warrant delay of the New Attack Submarine." Moreover, "...the New Attack Submarine is technologically robust and reflects the correct balance between cost and state-of-the-art technology." The following describes the major elements of technology on board the New Attack Submarine, which fall into four basic categories. They are:

- **Operational Requirements Performance** - technologies included to satisfy the operational requirements imposed by the warfighter;

- **Affordability** - technologies that reduce overall cost;

- **Re-engineering** - technologies which scale an existing SEAWOLF or OHIO class submarine technology to a smaller ship or present an opportunity to improve reliability, maintainability and availability;

- **Environmental Concerns** - technologies included to satisfy environmental regulations and other similar directives.

Specific examples of state-of-the-art technology in the New Attack Submarine design include:

- **Imaging** – The imaging subsystem provides virtually near all weather and night vision by using the latest commercial color and black & white cameras, as well as government-off-the-shelf infrared (IR) imaging, antennas for communications, radar early warning, radar and communications intercept, radar direction finding (RDF), radio frequency navigation (i.e. GPS) and marine band transceiver support. The IR camera is a new technology 3-5 micron, high resolution (640x480 pixel) staring array detector leveraged off the ASRAM air-to-air missile system. The sensors are all mounted in universal non-penetrating masts which allow maximum ship design flexibility, including unconstrained sail placement, the ability to locate the attack center on the mid-level platform/deck, and savings in footprint by eliminating inboard periscope wells.

- **Electromagnetic Silencing** - In the past decade there has been significant development of technologies to reduce submarine electromagnetic signatures. The New Attack Submarine program transfers efforts from NAVSEA , the Office of Naval Research and the Advanced Research Projects Agency. The New Attack Submarine program applies their advanced technology concepts by: developing the New Attack Submarine specific math and physical models for Electromagnetic Signature Control System design; producing prototype components for submarine qualification; and demonstrating the eventual system in full-scale experiments. This will result in an improved electromagnetic silencing capability compared to SEAWOLF.

- **Reconfigurable Weapons Shipping & Handling Module** - This project is developing a weapon stowage and handling system for the New Attack Submarine that provides 24 weapon stows; satisfies weapons reload rates, shock, and acoustic specifications; and provides reconfigurable space of 2400 cubic feet . This reconfigurable space is a key feature unique to the New Attack Submarine which provides substantial mission flexibility. Technologies being developed for this flexible system include: quiet, synchronized cradle drive motors and gears; more affordable, reliable electromechanical cradle locks; and re-engineered SEAWOLF quiet weapons hoists.

The following tables outline the new technologies incorporated into the New Attack Submarine design. A detailed discussion of these items is found in Appendix A.

TECHNOLOGIES INCORPORATED FOR OPERATIONAL PERFORMANCE

- Advanced Submarine Tactical ESM Combat System (ASTECS)
- Integrated ESM Mast (IEM)
- Sail High Frequency Array
- Advanced Mine Detection Sonar
- Lightweight Wide Aperture Array
- Counter Measure Launch Control
- Hull Sound Monitoring System
- AN/WLY-1 Submarine Defensive Warfare System

TECHNOLOGIES INCORPORATED FOR OPERATIONAL PERFORMANCE (cont'd)

- Impressed Current Cathodic Protection System
- Electromagnetic Silencing System
- Variable Speed Secondary Propulsion Motor
- Submarine Communications Support System

TECHNOLOGIES INCORPORATED FOR AFFORDABILITY

- Isolated Deck Structures
- Doppler Sonar Velocity Log
- Photonics Mast (Non Penetrating)
- Universal Modular Masts
- Sonar Software & Electronics
- Permanent Magnet Motors for Towed Array Handling Systems
- Machinery Sound Monitoring System
- Special Hull Treatment
- High Speed Emergency Diesel Generator
- Reconfigurable Weapons Handling & Stowage System
- Undermatched Welding
- Main Storage Battery
- Quiet Electro Mechanical Actuators
- Advanced Two Operator Ship Control
- Mechanically Attached Fittings
- Structurally Integrated Enclosures
- Navigation Sensor System Interface
- Non Tactical Data Processing
- Onboard Team Trainer
- Fiber Optic Cable Subsystem
- Open System Architecture Command and Control System Software & Electronics
- Ring Laser Gyro Navigator
- Propulsor
- Single Element Hangers
- High Speed Direct Current Ship Service Turbine Generator
- Integrated Gas Management System
- Vacuum Sanitary & Quiet Sanitary Blow
- Battery Electrolyte Agitation Blower
- Low Pressure Blower

TECHNOLOGIES INCORPORATED FOR RE-ENGINEERING

- Main Propulsion Unit
- Main Thrust Bearing
- Hull Penetrators
- Quieted Torpedo Tubes
- Hovering System Components
- Air Turbine Pump
- Main Shaft Seal
- Integrated Interior Communications System

TECHNOLOGIES INCORPORATED FOR ENVIRONMENTAL CONCERNS

- Anti Fouling Coatings
- Quiet Non Ozone Depleting Air Conditioning & Refrigeration

Benefit of Design/Build Process

The New Attack Submarine is using a design/build approach as the cornerstone for affordability and future technology insertion.

We have formed a partnership with the shipbuilder much earlier in the ship design process than on previous submarine programs. This early partnership led to the formation of integrated teams from the Navy, key component suppliers, designers and shipbuilder trades people to drive costs down by making prudent, early decisions on ship design.

The Ability to Incorporate Future Changes

Extensive efforts have been made to ensure the New Attack Submarine will remain the right submarine far into the next century. The design process itself has been structured to simplify the insertion of new technology. For example, design of the New Attack Submarine is being performed in a computer aided design, engineering and manufacturing (CAD/CAE/CAM) environment. The creation of the New Attack Submarine in a three-dimensional digital product model data base permits rapid assessment and evaluation of new technologies. In addition, development of a work package for incorporating a technological change is much more easily accomplished using this very accurate representation of the submarine.

Reservations for growth (margins) for the New Attack Submarine are known with higher confidence than in previous classes because of the design/build process being employed by the New Attack Submarine program. Weight and power margins have been better defined and are more readily controlled during the initial evolution of the ship's design. Consequently, they will be available to support adoption of future technology advances.

Some of the innovative design features which will allow advanced technology insertion in the future include:

- **Open System Architecture**. Using widely available public domain standards (including networks, operating systems, backplanes, graphics and interconnect protocols), the system will have well-defined interfaces that offer portability and reusability of software with future technology upgrades.

- **Fiber Optic Cable System**. The New Attack Submarine will have a platform-wide Fiber Optic Cable installation that will be sized for future growth. The structure of the network makes it easier to attach and integrate new equipment in a plug-in/plug-out manner.

- **Commercial-Off-The-Shelf (COTS) Electronics**. Using commercially available electronics allows the Navy to "leverage" the exponential growth in signal/information processing and display technologies occurring in industry, simplifying future technology upgrades.

- **Structurally Integrated Enclosures.** Provide standard electronic mounting interfaces embedded with the ship's deck structure to facilitate cost-effective replacement of advanced technology electronic components without space re-arrangement impacts.

- **Isolated Deck Structure:**

  - Facilitates equipment integration. All interfaces are well defined, which reduces the amount of effort required to replace existing equipment with technology upgrades.

  - Provides shock and acoustic isolation sufficient to allow the onboard use of commercial off-the-shelf (COTS) technology.

  - Provides a configuration which allows the insertion of active noise control technologies as they are developed.

- **Reconfigurable Torpedo Room**. This reconfigurability allows payload flexibility, including provisions for mission-specific equipment, carry-on electronics, alternative weaponry, and remotely operated, autonomous vehicles.

- **Universal Modular Mast**. Sail configuration incorporates standardized mast components and ship interfaces. It includes quickly configurable "mission-specific" mast location (which allows the addition of special-purpose antenna features). This approach provides flexibility for cost-effective application of evolving antenna and sensor technology such as the super high frequency (SHF) communications technology currently in development.

- **Large Logistics Hatches and Accesses**. These hatches enable removal and replacement or upgrade of ship equipment without the extensive time and cost of dry-docking and hull cuts.

- **New Design Electric Plant**. Based on commercial high-power solid state devices, the new design electric plant provides improved electrical harmonic isolation and is readily adaptable to a variety of electrical power requirements.

Advanced Research Projects Agency (ARPA) Technology

Since 1988, the Navy has worked closely with the Advanced Research Projects Agency (ARPA) to develop new submarine technologies. These technologies have been assessed and, where appropriate, used in the New Attack Submarine program based on merit and risk.

The status of Advanced Research Projects Agency projects relative to incorporation into the New Attack Submarine is provided as Appendix B.

Some examples where a technology is not included in the initial New Attack Submarine design are:

1. Advanced Vibration Reducer (AVR)

The AVR program is developing a full scale prototype system which reduces submarine acoustic signature. This will be accomplished by the application of vibration control technology. The technology is not included in the New Attack Submarine for two reasons: (1) the New Attack Submarine is presently projected to meet its noise goals and the AVR is considered a back-up risk-reducing technology; and (2) the AVR technology has not yet been successfully demonstrated. The AVR will undergo land-based testing beginning in late FY95 to FY96 and shipboard testing on the USS MEMPHIS R&D Submarine during FY97.

2. Power Electronics-MOS Controlled Thyristors (MCT)

The Metal Oxide Semi-conductor (MOS) Controlled Thyristor (MCT) is a solid state switching device that combines the proven efficiency and power handling capability of the Thyristor with the ease of control of the MOS field effect transistor used in electric power distribution systems. The potential benefits of these MCT devices are reduced cost, higher performance, and compactness. As such, it is a candidate application for high-power electric plant components as a weight and space saving substitute for Insulated Gate Bipolar Transistors (IGBTs). At present, MCT technology does not provide the voltage and current carrying capability required by the New Attack Submarine. However, this is an active development effort that has potential for incorporation into the New Attack Submarine.

3. Suprelite

This project involved the application of composite materials to a compound propulsor. The goal of this technology was to significantly reduce the cost and weight impact of the propulsor.

This was to be demonstrated by the full scale design and fabrication of major portions of the propulsor from composite materials and the conduct of at-sea evaluations.

An “Aft Item” was fabricated, installed, and operated satisfactorily for over a year, demonstrating the feasibility of the technology. An unexpected failure of this part in 1992 identified significant shortfalls in the ability to design and fabricate long service life marine structures employing composite materials. A new “Aft Item” may reasonably be viewed as an appropriate Pre-Planned Product Improvement (P^3I) candidate.

A 1/4 scale “C-Section” assembly and parts for a partial full scale unit have been manufactured; however, a complete full scale prototype has not been successfully fabricated. This highlights a major shortfall in the manufacturing technology required to support the development of a critical, dynamically loaded composite structure.

Conclusions

The Navy has carefully considered a wide spectrum of technology initiatives for the New Attack Submarine. Those technologies that show promise and are projected to reach maturity at a time consistent with the New Attack Submarine design/build have been incorporated.

The New Attack Submarine class will be the most flexible generation of submarines ever designed. This design will be "open" for the infusion of technologies that reach maturity subsequent to initial production. This is not only the Navy's view -- independent study groups have examined this issue and come to the same conclusion. **The Independent Review Group that examined the New Attack Submarine design concluded: "There are no emerging technologies on the horizon that warrant delay of the New Attack Submarine." Moreover, "the New Attack Submarine design is technologically robust and reflects the correct balance between cost and state-of-the-art technology."**

The Navy's approach to the design for the New Attack Submarine ensures our ability to accommodate changes in mission requirements and the future threat. The fundamental program objective remains to preserve and maintain our margin of undersea superiority at an affordable cost.

Appendix A
New Attack Submarine Technology Descriptions

TECHNOLOGIES INCORPORATED FOR OPERATIONAL PERFORMANCE

Advanced Submarine Tactical ESM Combat System (ASTECS) and Integrated ESM Mast (IEM)

Funds are being invested to develop a new Electronic Surveillance Measures suite and associated submarine-unique sensors, and to adapt commercial and other military service technologies for the processing and display suite to automatically detect and classify radar and communication signals.

Lightweight Wide Aperture Array

The lighter weight wide aperture array, which supports acoustic contact detection and rapid localization, will make use of advanced technology fiber optic outboard arrays and telemetry. R&D funds are being invested to achieve significant outboard weight reduction, apply corrosion resistant materials, and improve reliability; as well as to reduce recurring and life cycle cost.

Sail High Frequency Array and Advanced Mine Detection Sonar

In current and projected future submarine missions, the New Attack Submarine will be required to operate in a number of shallow water littoral environments known to be mined with floating, moored, bottom and near-bottom mines. R&D funds are being invested to develop the acoustic array suite to complement enhancements to the associated processing and displays to cost effectively provide the capability to operate in littoral waters with reduced vulnerability.

Hull Sound Monitoring System and Machinery Sound Monitoring System

This system will provide extensive own ship self noise monitoring to improve stealth performance. The system will incorporate commercial based processing and displays.

AN/WLY-1 Submarine Defensive Warfare System and Countermeasure Launch Control

This system will provide earlier alertment and greater self protection against threat weapons. Funds are being used to develop the system and associated acoustic arrays and to incorporate Commercial Off the Shelf signal processing and display technology.

Appendix A
New Attack Submarine Technology Descriptions

Impressed Current Cathodic Protection System
This will replace traditional zinc-based corrosion control with automated control of corrosion galvanic currents to minimize the ship's electric field signature. Added benefits are lower life cycle costs of numerous corrosion susceptible components, potential for lengthening the span between ship dry-docking, and better "localized" control of corrosion currents.

Variable Speed Secondary Propulsion Motor

Precision slow speed maneuvering control for special warfare missions is being developed by adapting the SEAWOLF Secondary Propulsion Motor for variable speed operation.

Electromagnetic Silencing System

In the past decade there has been significant development of technologies to reduce submarine electromagnetic signatures. This program transitions efforts from various Navy activities and the Advanced Research Projects Agency to provide a complimentary set of sub-systems to significantly reduce the New Attack Submarine's electromagnetic signature.

Submarine Communications Support System

R&D funds are being invested to develop the submarine unique high data rate antennas, installation packaging and associated processing and display equipment needed to implement secure and non-secure voice, video, imagery, and narrative record messages to allow full submarine interoperability with joint warfare forces of the future.

TECHNOLOGIES INCORPORATED FOR AFFORDABILITY

Isolated Deck Structures

Integrated deck structures and high capacity isolation devices (mounts) are being developed under this effort. The use of large deck structures will allow maximum installation of equipment in an efficient shop environment vice "in-hull" where access is very limited. The isolation mounts will reduce shock and acoustic requirements for ship components, which will reduce individual component cost, weight, and simplify integration into the ship. This allows COTS hardware components to be used without modification.

Structurally Integrated Enclosures (SIEs)

A universal packaging approach is being implemented across all C^3I system subsystems to afford recurring cost savings by reducing overall C^3I system space and weight requirements and by simplifying and minimizing the number of platform-to-C^3I system interfaces. This is accomplished by using a common structure for ship support and C^3I

system electronics housing as well as reducing the number of C^3I equipment enclosures. Additionally, other environmental effects (e.g. humidity, electromagnetic, temperature) are being mitigated through the use of SIEs. Cost effective technology insertion upgrades to C3I systems are also facilitated by the use of SIEs by reducing the physical upgrade to circuit card and electronic drawer exchanges and modest internal recabling within the enclosures.

Doppler Sonar Velocity Log

The New Attack Submarine will utilize the speed sensing system being developed for use for Navy surface ships. This development effort will adapt the current transducer for use at submergence depths and incorporate commercial technology into the design of the system.

Photonics Mast (Non Penetrating) Imaging

The imaging subsystem provides near all weather and night vision by using the latest commercial color and high resolution black & white camera technologies, as well as government-off-the-shelf infrared (IR) imaging, integral communications antennas, radar early warning, radar and communications intercept, radar direction finding, radio frequency navigation (i.e. GPS) and marine band transceiver support. Adaptation of commercial technology is being applied to ensure the capability to perform real time image enhancements, store and enhance still video frames, and record these images for future use. The sensors are all mounted in non-penetrating masts which allow maximum ship design flexibility.

Universal Modular Masts

The sail mounted electronic sensors and antennas for the ship will be housed in a common design mast cell that will provide a standard mechanical interface to the ship and to the sensors. This will afford parts standardization, reduced life cycle costs and more efficient installation. The operational advantages of this system will be the easy adaptability to new design sensors in the future and the ability to easily tailor the sensor suite for special missions.

Permanent Magnet Motors for Towed Array Handling Systems

An electric motor drive and control system for towed sonar array handling is being developed to reduce the risk of damage to the towed arrays during deployment and retrieval of the array. Additionally, elimination of the hydraulics supply traditionally used for this purpose will reduce the production cost of the ship and the life cycle cost of the system.

Appendix A
New Attack Submarine Technology Descriptions

Open System Architecture Command and Control System Software & Electronics and Commercial-Off-The Shelf Technology (COTS)

COTS technologies are being adapted for use in New Attack Submarine in order to meet overall affordability and capability objectives. A modern information management system which electronically connects all major C^3I functional subsystems for data sharing requirements is being implemented. It will feature a state-of-the-art network or backbone to leverage emerging commercial-based technology that provides a flexible and adaptable solution to support current and future mission performance requirements. The **Non Tactical Data Processing System, Onboard Team Trainer, Navigation Sensor System Interface, Sonar Software & Electronics** systems and the **Fiber Optic Cable Subsystem** are all being developed to take maximum advantage of the use of COTS.

Ring Laser Gyro Navigator

R&D funds are being invested to integrate the ring laser gyro replacement for the Electrically Suspended Gyro Navigator (ESGN) currently in use on submarines to achieve significant recurring and life cycle cost savings.

Special Hull Treatment

Special hull treatments provide significant contributions to submarine quieting and susceptibility to active sonar detection. The principal focus is development of a new industrialized Mold-In-Place (MIP) installation process which significantly reduces installation time. Part of the materials development effort is examination and testing of ONR-sponsored alternative materials research for engineering applications to the New Attack Submarine.

Propulsor

The propulsor is a key ship acoustic signature driver, particularly at higher ship's speeds. The goal of the New Attack Submarine propulsor development is to leverage SEAWOLF propulsor technologies as well as advances from Advanced Research Projects Agency (ARPA) and Office of Naval Research (ONR) research in hydroacoustics to develop a more affordable propulsor that satisfies anticipated ship performance and acquisition cost objectives.

High Speed Emergency Diesel Generator

This effort leverages from commercial industry development to procure and qualify for submarine use a smaller, reliable and cost effective emergency diesel generator set. Modern diesel engines, already used extensively in commercial applications, have a lower initial cost than engines used on predecessor U.S. submarines and are significantly smaller, enabling added savings through ship internal arrangements flexibility and reduced footprint.

Single Element Hangers

This development effort utilizes advances in acoustic energy propagation reduction and materials technologies to develop resilient hanger assemblies for piping isolation. This technology replaces current pipe hanger implementations, which are very constraining to ship arrangements, with reduced volume, more effective assemblies which will yield both weight and cost savings.

Reconfigurable Weapons Shipping & Handling Module

This project is developing a weapon stowage and handling system for New Attack Submarine that provides weapon stowage; satisfies weapons reload rates, shock, and acoustic specifications; and provides a large, open, readily reconfigurable space when not filled with weapons. This reconfigurable space is a key feature unique to New Attack Submarine which provides substantial mission flexibility.

High Speed Direct Current Ship Service Turbine Generator

The effort provides for design, manufacture and test of a Ship Service Turbine Generator set for the new design Direct Current Ship's Electrical Distribution System that is reduced in cost, weight and volume relative to previous submarine designs. It incorporates technologies such as advanced power electronics, high speed turbine machinery, and advanced bearings and control systems.

Undermatched Welding (Advanced Welding Processes)

This is a materials and welding technology evolution from SEAWOLF development that yields significant recurring cost reduction by reducing lengthy preheating process time required prior to welding high yield steels used in the ship's hull and major structures.

Integrated Low Pressure Oxygen Generating Plant & Gas Management System

The development incorporates lower pressure electrolysis cells than current submarine units, which improves safety of operations and maintenance, eliminates the need for separate oxygen storage and reduces ship manning requirements. This upgrade also includes more affordable and lower maintenance control electronics.

Appendix A
New Attack Submarine Technology Descriptions

Main Storage Battery and Automatic Battery Monitoring System

This effort applies the latest high capacity storage battery technology to increase expected battery life, reduce future life cycle costs. Additionally, it will reduce battery installation and removal labor hours by replacing hand tailored wooden wedges with adjustable fiberglass wedges. Additionally, this project will design, develop, and qualify the New Attack Submarine Automatic Battery Monitoring System which is smaller, more highly automated and more cost effective than previous systems.

Vacuum Sanitary & Quiet Sanitary Blow

A Vacuum Collection, Holding and Transfer System is being applied for the first time in submarine design to reduce holding tank volume requirements, improve arrangements flexibility, and to reduce total ship acquisition and life cycle cost. The effort entails adapting the technologies currently in use on surface ships for quieted applications in the submarine environment.

Quiet Electro-Mechanical Actuator (EMA)

This program will develop an electro-mechanical actuation system which meets the noise and safety goals for operation of mechanical valves and drive systems throughout the ship. It will result in a reduction of ship cost and weight by replacing high pressure, quieted hydraulic actuators and their associated hydraulic piping, with quieted electrically controlled and powered EMAs derived from those used extensively in modern aircraft.

Battery Electrolyte Agitation Blower

This project entails the adaptation of commercial blower technology for the submarine's Battery Electrolyte Agitation System, used to circulate battery electrolyte. It is intended to replace the unique, Military Specified units on current submarines.

Advanced Two Operator Ship Control

The ship control system is critical to ship safety and precisely maneuvering the ship to perform its missions. The New Attack Submarine is adapting and developing multiple automation technologies to realize a robust, flexible, affordable, state-of-the-art Ship Control System. Technologies are being integrated in a new Ship Control Station which requires fewer operators and reduces maintenance and ship arrangement impacts.

Appendix A
New Attack Submarine Technology Descriptions

Low Pressure Blower

This project entails the investigation of commercial blower technology for the submarine's Low Pressure Blow System, used to ventilate the ship. It is intended to replace the unique, Military Specified units on current submarines.

Mechanically Attached Fittings

This project is applying commercial technology to develop fittings to join low pressure and temperature piping systems without welding or brazing. Lower labor costs are expected as a result of reduced installation time and elimination of hot work.

Reverse Osmosis Desalination Plant

Significant cost savings will result from the use of a reverse osmosis (RO) desalination plant on the New Attack Submarine. This technology is a replacement for the distillation systems used aboard current submarines. The project focused on adapting the technology for quiet submarine operations at varying seawater supply pressures to produce the high purity of water required for various submarine needs. The reverse osmosis system will cost less to acquire and maintain.

TECHNOLOGIES INCORPORATED FOR RE-ENGINEERING

Main Propulsion Unit

The focus is to design, manufacture, and test a scaled down Main Propulsion Unit which reduces cost without compromising performance or reliability. This project capitalizes directly on the advanced machinery quieting technologies developed for the SEAWOLF unit.

Hovering System Components

The project focus is on re-engineering the quiet SEAWOLF hovering components for the New Attack Submarine ballasting requirements. Alternative pump and valve quieting technologies are being developed to satisfy New Attack Submarine specific ballasting rates and differing acoustic transmission paths.

Main Thrust Bearing

This effort will develop a reliable Main Thrust Bearing/Vibration Reducer with the objective of minimizing cost, size, and weight. It entails re-engineering SEAWOLF advanced bearing technology which results in significant quieting enhancements over predecessor systems and also develops new materials for the internal bearing wear surfaces to enhance long term durability.

Air Turbine Pump

This project is developing a more cost effective weapon launch system for the New Attack Submarine. Development is proceeding with the TRIDENT Submarine derived, quieted MK 20 Air Turbine Pump System for the first New Attack Submarine. However, the New Attack Submarine design is flexible to allow installation of either the reduced cost developmental Elastomeric Ejection System when its design is mature, or the Modified MK 21 SEAWOLF Air Turbine Pump System, should future threats dictate need for further reduction in weapons launch signatures.

Hull Penetrators

This effort will develop pressure hull penetrations capable of higher electrical currents. This will reduce the number of penetrations required with resulting reduced fabrication and maintenance costs.

Main Shaft Seal

This effort will re-engineer the SEAWOLF Main Shaft primary seals, seal housings, and stern tube seal to meet the New Attack Submarine performance and acoustic requirements. This will provide a lighter and less expensive system with fewer maintenance problems associated with the stern tube seal.

Quieted Torpedo Tubes

This effort will develop a 21-inch diameter torpedo tube and firing system derived from SEAWOLF large bore tube design by re-engineering quieting and shock survivability technologies. This will provide a torpedo tube at significantly reduced size, cost, and ship installation impact.

Integrated Interior Communications System

This project will develop an integrated voice, alarm and announcing system using commercial technology. It will also incorporate for the first time on submarines a wire free communication system within the ship.

Appendix A
New Attack Submarine Technology Descriptions

Propulsion Shaft

Using advanced material technology, this project re-engineers a steel shaft for the New Attack Submarine propulsion plant which is compatible with the power, torque, thrust, and long-term corrosion resistance required.

TECHNOLOGIES INCORPORATED FOR ENVIRONMENTAL CONCERNS

Anti Fouling Coatings

This program will test and evaluate new, non-polluting and biodegradable, environmentally safe, anti-fouling (AF) coatings for application over advanced special hull treatment. It will result in extended service life for underwater hull coating system with a minimal environmental impact. Cost reduction will be achieved by reducing maintenance and extending the coating replacement periodicity.

Quiet Non Ozone Depleting Air Conditioning & Refrigeration

This project is developing and testing an environmentally safe HFC-134a Air Conditioning Unit and a quiet ship stores refrigeration plant for use on New Attack Submarine that complies with the U.S.-signed Montreal protocol agreement. Development is leveraging other Navy projects to convert to HFC-134a refrigerant as a non-ozone depleting substance. The challenge is to satisfy quieting requirements with units that operate at significantly different temperatures and pressures than prior submarine units.

Appendix B
Advanced Research Projects Agency Technology Descriptions

Advanced Research Projects Agency (ARPA)
Submarine Technology Project Transition Summary

Full Scale Technology Demonstrations

Project	Transition Year	Navy	Status
Non-Penetrating Periscope	92	C	1
Axial Flow/Shaftless Pump	93	C	2
Classified Project P	93	C	2
Enhanced Surface Tube Condenser	94	O	3
Electromagnetic Countermeasure Launcher	94	S	3
Expendable Buoy Camera	94	S	5
Silver-Zinc Battery	94	S	5
Advanced Design Nickel Cadmium Battery	95	S	5
Metal Oxide Semiconductor Controlled Thyristor	95	C	2
Advanced Propulsor (SUPRELITE)	96	TBD	3

Partial Scale/Component Technology Demonstrations

Project	Transition Year	Navy	Status
Magnetic Bearings	91	C	1
Through the Hull Cooling	91	S	5
Torpedo Lateral Launch System	91	S	5
Classified Project I	92	S	4
Classified Project S	92	S	4
Advanced Turbine Generator Seals	93	S	5
Submarine Advanced Integrated Life Support System	93	S	5
Two Wire Automatic Sensing & Evaluation System	93	S	5
Alternate Emergency Power Source/Fuel Cells	94	S	3
Classified Project F	94	C	2
Classified Project AIM	95	C	3
Signature Management System	95	TBD	3
Classified Project M	96	TBD	3
Embedded Sensors	96	TBD	3
Highly Damped Lightweight Structures	96	TBD	3
Thick Section Composite Component	96	TBD	3

Legend:

C - Continuing Navy Development
D - Data Library
O - Operational Capability
R - Research and Development Facility/Asset
S - Shelved for Future Consideration

TBD - To Be Determined

1 - In Lead Ship NSSN
2 - P^3I for NSSN
3 - More Than 10 Years After NSSN
4 - ARPA Terminated
5 - Does Not Meet NSSN Requirements
6 - Various Studies

Appendix B
Advanced Research Projects Agency Technology Descriptions

Submarine Technology Project Transition Summary

Capabilities

Project	Transition Year	Navy	Status
Foreign Gear Technology	91	D	1
Hydrodynamic Computational Workstation	91	R	1
Silent Actuators for Control Surfaces	91	S	3
Structural Acoustics University Initiatives	91	D	3
Electromagnetic Signature Reduction	92	C	1
Intermediate Scale Measurement Facility Design	92	R	1
Hydrodynamic/Hydroacoustic Technology Center	93	R	1
Advanced Electric Drive	94	C	3
Joining Technology - Advanced Metals	94	D	3
Magnetohydrodynamics	94	C	3
Pressure Spectrum Measurement System	95	R	1
Radio Controlled Model Enhancement	95	R	1
Submarine Stealth Design Workbench	95	TBD	3
Composite Technology	96	TBD	3
Advanced Technology Submarine Operations in the Littorals	97	TBD	3
Electromagnetic Turbulence Control	97	TBD	3
Classified Project N	97	TBD	3

Knowledge Base

Project	Transition Year	Navy	Status
Advanced Drag Reduction	91	D	6
Bi-Phase Turbine	91	D	6
Electrorheological Fluids	91	D	6
Flow Assisted Launch Feasibility	91	D	6
Liquid Helium Wind Tunnel	91	D	6
Pulse Power Technology	91	D	6

Legend:

C - Continuing Navy Development
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S - Shelved for Future Consideration

TBD - To Be Determined

1 - In Lead Ship NSSN
2 - P^3I for NSSN
3 - More Than 10 Years After NSSN
4 - ARPA Terminated
5 - Does Not Meet NSSN Requirements
6 - Various Studies

Appendix B
Advanced Research Projects Agency Technology Descriptions

Submarine Technology Project Transition Summary (cont.)

Knowledge Base (Cont.)

Project	Transition Year	Navy	Status
SUBOFF (Submarine Compute Off) Experiments	92	D	6
Electro-Chemical Parameter Study	94	D	6
Acoustic Experiments	95	D	6
Advanced Maneuvering Control Station	95	D	6
Advanced Propulsor Concepts	95	D	6
Automated Damage Control System	95	D	6
Flow Control Devices	95	D	6
Laser Flow Field Measurement	95	R	1
Maneuvering Experiments	95	D	6
Non-Acoustic Experiments	95	D	6
Propulsor Experiments	95	D	6
Radio Control Captive Model Experiments	95	D	6
Submarine Engagement And Automated Planning And Control System	95	D	6
Spatial/Temporal Inflow Experiments	95	D	6
Submarine Operational Automation System	95	D	6

Legend:

C - Continuing Navy Development
D - Data Library
O - Operational Capability
R - Research and Development Facility/Asset
S - Shelved for Future Consideration

TBD - To be determined

1 - In Lead Ship NSSN
2 - P^3I for NSSN
3 - More Than 10 Years After NSSN
4 - ARPA Terminated
5 - Does Not Meet NSSN Requirements
6 - Various Studies

SUMMARY OF ARPA PROJECT ACTIVITY	# OF PROJECTS
In Lead Ship NSSN or P^3I	14
More Than 10 Years After NSSN	20
ARPA Terminated	2
Does Not Meet NSSN Requirements	8
Subtotal	**44**
Various Studies - Paper Only	20
Total	**64**

DETAILED ITEM DESCRIPTIONS

Will be provided via separate, classified, letter.

Mr. HUNTER. Admiral, thank you very much. I want to mention while we have our panelists here, I want to have some back and forth as well from members of the committee. If you have a pressing point, any member of the panel can make that point or raise that issue.

Admiral Frick, let me just ask you, EB at one time, and I have got their recommendation here, Electric Boat recommended a strategy that involved operational prototypes. Let me just quote. They proposed a new "winning strategy to the Navy in the face of a risk-averse acquisition process, ill-suited to maintain technology, design and construction basis in the face of declining budgets." And this strategy that EB gave you called for design and construction of operational prototypes.

Now, one other member of the Aspin panel who is not here with us today also made a similar comment. Let me quote that comment. "The important point is that Soviet subs are now quiet enough to give our antisubmarine warfare system a real problem. It is fair to say that the submarine-antisubmarine warfare game has changed as a result of this introduction. We must now restructure our ASW systems to recognize this new reality. Therefore, the question comes down to what we should be doing during this 5- to 10-year period, this grace period, you might say," and I think that is basically what Mr. Polmar stated.

The deficiencies are that we have not yet formulated the new architecture that would tie together the new sensors as they are developed nor have we begun a vigorous program on what I would call the back end of the R&D effort, picking up ideas that we have developed, putting them into prototype form and testing them at sea.

"We sense a reluctance, an understandable reluctance to commit the resources necessary to enter this new phase in the ASW program." That was a member of the blue ribbon Aspin committee who is not here right now. His name is Bill Perry. That was what he said in his testimony to this committee was that we should do operational prototypes.

Electric Boat, in their recommendation to you, said we should do operational prototypes. Now, you have come today to comment on the committee's position and our position with respect to the pending conference which recommends operational prototypes, and you seem to be excluding any operational prototypes because you have got just about the best stuff in town in the New Attack Submarine, according to the statement you just made. Why do you think Bill Perry was wrong?

Admiral FRICK. Mr. Chairman, I don't think Dr. Perry was wrong. I do think his statement is dated. There has been an explosion in technology.

Mr. HUNTER. Well, how many operational prototypes have you made since his statement?

Admiral FRICK. We have done several prototypes in various technology areas that are at sea today. Those are minor in nature. They are not major ship prototypes. But the technology explosion that has occurred in communications and combat systems and connectivity is the area that is most important now. That is what is going to make the submarine an effective platform, and that is in the New Attack Submarine Program.

That RFP is on the street to combat with the best open system architecture that will bring us up to date and allow—there will be continuing explosions for the next many years, allows the rapid updating at an affordable cost, and so you take the front end, the combat system of this ship and it can be, it is in the design to be quickly upgraded by swapping boards rather than today if we have to upgrade the 688 to a new combat system. We actually have to gut the front end of that ship. That is unaffordable.

Today, with New Attack Submarine we insert those same changes, the upgrade with whatever comes easily and cheaply by swapping boards. It is proven in industry, it is proven in other military programs, and that in the New Attack Submarine plan.

Mr. HUNTER. So let me understand this. You said that basically the idea of prototypes is obsolete. You don't need to do them anymore?

Admiral FRICK. Certainly in the area of combat systems we do not, unless some new sensor technology comes along, which there is none that I know about right now that would warrant any changes. In the combat systems area we can mock all this up. We are doing it today. We have been doing it now for the past three years at a land-based facility, prove it, and then we can just swap the boards and put them in place.

Mr. HUNTER. The second thing you have just told me is that in the *Seawolf*, this proposed $2.8 billion *Seawolf III* the Navy did not put in the ability to evolve the electronics which is changing at a fairly rapid rate.

Admiral FRICK. The *Seawolf* will have to come through that, but the basic *Seawolf* design was not a design—it was for open system architecture. We are going to figure out how to do that in the future, but that is not in the design.

Mr. HUNTER. What you are saying is the *Seawolf* technology, the front-end technology as it ages, and it is going to age quickly because the revolution is so, the curve is so steep it will not be a system we can evolve with new electronics?

Admiral FRICK. The system now, we are doing software upgrades and the hard drive technology is so rapid, the throughput technology that *Seawolf* will be able to keep up. It will be more than well ahead. It is so far ahead right now, including things like automation. We are now doing upgrades in software for automation on *Seawolf* and using that as a prototype for New Attack Submarine, so even though *Seawolf* was not designed for that, we will have to go back and figure out how we can go insert boards rather than doing like we did with the 688 class.

Mr. HUNTER. What you have got on the new boat is these racks where you can plug and unplug this electronic equipment. You can update it, right?

Admiral FRICK. Yes, sir.

Mr. HUNTER. But you didn't do that on *Seawolf*?

Admiral FRICK. The *Seawolf* does not have that in the basic design, since the basic design now is almost 10 years old. That is the reason why this New Attack Submarine has come so far ahead. It, in fact, is the platform that can become different ships. It is modular, it can be prioritized to different missions, but relatively easy, certainly much easier than any previous submarine class.

Mr. HUNTER. Let me ask you a question of *Seawolf III*. If you are going to build *Seawolf III*, you are asking us for an extra billion and a half to build it this year, shouldn't we build it with evolvable electronics, plug in-plug out? You can't do that. You can't put the racks on them like you are talking about?

Admiral FRICK. No, sir. That would be a major redesign of the front end of the ship.

Mr. HUNTER. If anybody else wants to comment on that, go right ahead.

Mr. BATTISTA. Mr. Chairman, if I might, I have to respectfully disagree, principally because I remember history very well. I worked for you when I heard these same words back in 1983, and I told you, reminded you that you had a $908 million overrun, close to a billion-dollar overrun in one single year for this combat system when it was supposed to do very many of the same tasks that the admiral is describing here this morning.

I haven't seen any technology explosion that obviates the need for prototyping. I don't think Bill Perry's statement is dated. I think Bill would probably tell you the same thing today that he did just those few short years ago.

Mr. HUNTER. I may give him the chance.

Mr. BATTISTA. Let me say the Advanced SubTech Program started right here in this committee; you did it. You didn't get what you asked for. You asked for a prototype submarine in that Advanced SubTech Program. You got a very well done hubcap. You had a very well made fuel injection system, to give you an analogy, but you never got the car, and when we talk about mature technology and the ability to insert technology in the future, let me just remind you, as I said in my statement, and I didn't use it in my opening remarks, the technology budget for the Navy, for the Office of Naval Technology, which is headed by a very capable individual today, Admiral Poliath, their budget is borderline silly.

We have taken the money out of electric drive. We have taken the money out of the advanced torpedo handling and ejection system. We have not done a thing in magneto hydrodynamics. What is scary when you look at that Soviet *Mike* submarine in the water tooling along at about 8 knots there is no bow wake. You have to ask yourself how did they obviate the bow wake. In fact, did they use MHD [magneto hydrodynamics]? But all our money is gone.

So when I hear words like, well, we can put technology in as it becomes ready, there is no budget to develop that technology to put it in right now, and I have to contend that I think your position to add money to the submarine budget and to add money to technology is the only solution for the future, and I say with all due respect to Admiral Frick, he certainly has the expertise as an operator that many of us don't have, but from a technology perspective, I don't think we are there, and I think the need for prototyping is still here very much in need right now.

Mr. HUNTER. Dr. Wood.

Mr. WOOD. Mr. Chairman, I would just like to invite your attention and consideration to the contrasting statements, and I respectfully suggest that the contrast is profound between Admiral Frick and Mr. Polmar. Mr. Polmar invited your attention and consideration to the fact that Russian submarines that we see being launched at the present time are superior in virtually every respect, not comparable to, but superior to what we expect *Seawolf* and New Attack Submarine to be in fundamental submarine, attack submarine features such as operating speed, such as dive crush depth, such as advanced hydrodynamic quieting and acceleration features.

He listed about eight fundamental features there in which Russian submarines were currently superior to United States submarines and pointed out in his quotation of Admiral Boorda's statement early this year that the United States had basically sacrificed everything on the altar of quietness, and yet Russian submarines are now as quiet or quieter than American attack submarines.

There is no doubt that American submarines have safer nuclear power plants propelling them. There is no doubt that they have the most modern electronics in the world, but in every other respect you heard Mr. Polmar state that they were inferior to Russian submarines, and yet you heard Admiral Frick say this is the best the Navy can do.

The New Attack Submarine represents the best in every respect, of which the U.S. Navy and implicitly the American technology base are capable. That is an exceedingly striking dichotomy. We have always considered ourselves to be technologically superior to the Russians, not equal to them but way in advance, and yet we are told that their attack submarines today are superior to ours in every respect except reactor safety and modern electronics, an exceedingly fundamental distinction between Mr. Polmar's statement and Admiral Frick's.

I think this committee and the Congress should think very long and hard about what that says about the United States Navy's use of the American technology base and the Russian Navy's use of the Russian technology base very long and hard, sir.

Mr. HUNTER. Dr. Foster, do you have a question?

Mr. FOSTER. Mr. Chairman, perhaps it will be useful if I just made a comment about this word "prototype." I use the words, "rapid prototype," and let me just say a word about it. In connection with a submarine design one can think of a submarine in which there are several modules, several sections of the submarine that provide for different functions and operations aboard the sub. It might be a command and control section where you are worried about how to more efficiently handle the information that comes from the sensors to the launching of various weapons. That whole process is a very involved process, involving a lot of people sitting at screens looking at information coming in, trying to make decisions. That is not unique to submarines.

We have two men in the cockpit of a 767 doing all that in hundreds of aircraft aloft today. There are other issues having to do with the automation of functions on the submarine. This is a cultural issue. It is also a practices issue. It is a technological issue.

Now, in my word, "rapid prototyping," I was talking about taking a module of these functions, the equipment, the people on land operating it, not a whole submarine going to sea, a module. When you put it all together for the first time, put the people in and train them, there will be some problems, it won't work. You will see some limitations. It will be clear what you do to remove the limitations. It isn't a matter of going through the whole cycle of designing a whole submarine. It is a matter of months to upgrade it, change it, rapidly prototype it again and again, go through two or three generations there on land until you have the equipment and the software and the people trained to provide a revolutionary capability in that module.

Now, you do it at the same time to other modules until you are ready to put these together in a new submarine and put it to sea. Thank you, Mr. Chairman.

Mr. HUNTER. Thank you.

Mr. BATTISTA. Mr. Chairman, one final point, board swapping may be new to the submarine community, but it is not a new technology or a new capability. It has been used in the industry for at least the last decade, and I can tell you that, for example, in the advances we have made in galiamorcinide technology we could actually incorporate galiamorcinide on a system that has been in existence for 5, 10, 15 years, so this may be new to the submarine community, but board swapping is certainly not anything that I would even consider a technological breakthrough.

Mr. HUNTER. Thank you. Let me get Mr. Polmar, then we will go immediately to questions of other members.

Mr. POLMAR. Let me, if I may, sir, point out that Admiral Frick, Dr. Foster is certainly a leading technologist in this area and I look at this very differently as a historian and as an analyst.

Let me make two quick points in that context. One, the submarine that is disturbing us today, that is ahead of us today is the improved *Akula*, which is a third generation nuclear submarine. The *Akula II*, a further improved third generation submarine is on trials now, I believe. I don't know if we have any data.

They are building and started almost 2 years ago building the fourth generation nuclear submarine, the *Severodvinsk*. The Malachite Design Bureau in St. Petersburg has probably completed by now the design for the fifth generation SSN, and let me assure you the Rabin Design Bureau, which is their competition, has their idea of what the fifth generation submarine should look like. That is item 1.

We are worried about something that is in the water and operating today and let me assure you from my personal knowledge the fourth generation is under construction, the fifth is well into design.

Second quick point. In 1989 the Aspin committee report stated——

Mr. HUNTER. Let me halt you at that point. The fourth generation is under construction, keel laid December 1993.

Mr. POLMAR. Yes, sir.

Mr. HUNTER. That, I have got the Naval intelligence analysis of the quieting of that submarine versus what the New Attack Submarine will do, and they are basically even with respect to quieting. Is that your——

Mr. POLMAR. Based on talking to the heads of the two design bureaus and based on their history, if you look at the shape of the curve of the last few years, there is no way that submarine will not be quieter, significantly quieter than the improved *Akula*. I mean, again, just look at it from a viewpoint of history, the shape of the curve, plus when these people tell me, when I say what are your priorities for the next-generation submarine, speaking of the *Severodvinsk* and they say A, B, and C, and depending upon who you talk to A or B is quieting.

The second point I would respectfully make, sir, is again the 1989 Aspin committee report stated, "the Navy establishment, like many organizations of comparable size and age, is burdened with traditional, deeply rooted and powerful vested interests that encumber innovation on the scale required." That remains, in my opinion, true today.

We see within the Navy, again my personal opinion, in the Office of Naval Research an exception to this, and part of the reason is the current Chief of Naval Research was formerly with the DARPA SubTech Program and apparently understands what the opportunities are, but as Mr. Battista said, those budgets have been cut, and we are talking about an organization significantly separated, in our opinion, from the submarine design process.

Mr. LONGLEY. Admiral Frick, I noticed you shaking your head. Do you want to comment on some of Mr. Polmar——

Admiral FRICK. I have to disagree with a couple things. One is that when you get into quieting technology and improvements in quieting, mother nature has to come in sometime, and the Soviets or the Russians are now reaching that point that the laws of physics are going to take over.

As Dr. Foster and some others said, with the help of our friends Walker and Whitworth and the Japanese that allowed that technology to flow, they were able to make rapid, dramatic improvements and at first we didn't know how that was happening or where it was coming from until the intelligence community figured that out, but that is a point now. There is not going to be another major improvement in sound quieting. The technology is not there. The laws of physics are going to keep that from happening.

Second, when you talk to the Russians, submarines are better than United States submarines in all respects, and I have heard those words here. That is a gross statement that should not be allowed. They are not better in all respects. Depth is not a major factor in submarine versus submarine operations. Speed is not a factor. Tactical speed is, stealth is, combat systems and weapons capability is, and the New Attack Submarine has all those capabilities.

Mr. HUNTER. Let's have a little back and forth.

Mr. BATTISTA. Let me disagree with that, Mr. Chairman. I don't think the Russians have found themselves to be at the end of the laws of physics. The admiral says depth is not important. That is entirely true in terms of submarine-to-submarine type engagements. However, we have learned in the last 3 years that depth is extremely important because it is the depth where you can capitalize on your vortices and use these for drag reduction, for speed advantage, and indeed for quieting, so these are technologies, by the way, that our people in this country don't even understand.

We went to the most qualified computational fluid dynamist at NASA, and he was thoroughly shocked over what happens at these different depths, so I don't think we are at the end yet, and let me say there are two elements to quieting—acoustic and nonacoustic.

I can tell you for a fact that the Russians know how to inject polymers into the boundary layer. They know how to put gas injection into the boundary layer. They know the effects of that gas injection into the boundary layer in terms of advantages across the spectrum, and we still to this day don't understand that phenomenology and this is what really worries me, and the bottom line that I come up with is if your position prevails and you are wrong, you have spent a little extra money to make darn sure that we remain superior.

If, in fact, the Navy is wrong, think of the consequences. You have now jeopardized the whole carrier battle group, and you have jeopardized your ability to keep those sea lanes open. We have had too many surprises, and, unfortunately, we are in an open session here now, but there are many instances where we got surprised by the Russians in a manner that is very, very alarming, so I have to say we are not at the end of that quieting spectrum yet. We still have a lot of the laws of physics we can explore.

Mr. WOOD. Mr. Chairman, as a physicist——

Mr. HUNTER. I want to get to my members shortly so make it short.

Mr. WOOD. As a physicist, I am somewhat alarmed when I hear people assuring other folks that the laws of physics permit this and forbid that and so forth. I will assure you, Mr. Chairman, as a physicist who has looked into these matters at considerable depth that the physics of three dimensional flow around complex bodies such as the case in underwater transit by submarines is very poorly understood.

I am very much concerned that the Russians have better operational understanding of the applied physics of subsonic flow and viscous media than the United States, either civilian or military, but very definitely the United States Navy. They have demonstrated, as Mr. Battista just pointed out on many occasions they understand these things better than we do, the fundamental physics, sir, and what the limitations are are not at all clear, the admiral's statement notwithstanding.

Mr. FOSTER. Mr. Chairman, just quickly add to that.

Mr. HUNTER. Mr. Foster, let me say to my members, I thank you for bearing with us, but we don't often get an interaction with a debate between our scientists and our service leaders, and I think this is an important dialog. Go ahead, John.

Mr. FOSTER. Well, as the admiral said, Mr. Chairman, sound levels are going down, and getting to the point where that may not be the most important thing, and that is why this issue about other signatures became important.

In my testimony, I talked about this phenomena which we do not understand. The Russians make certain claims. There is some intelligence evidence that they can do this or that and we don't understand it. This isn't a matter of laws of physics, it is a matter of just not understanding how you use those to achieve results. That is the difference.

Mr. POLMAR. Mr. Chairman, if I can make two very quick comments. One, in 1985—oh, I am sorry.

Mr. KENNEDY. I want to understand the fundamental difference in what you are putting, we are putting forward in the committee report on prototyping because I heard Dr. Foster say his idea of prototyping was the computer integration and that it was on land and that is what they are doing up in NUWC [Naval Underwater Weapons Center] in my State of Rhode Island.

What I am trying to understand, if that is the same thing that everyone else on the panel understands is what prototyping means from the chairman's mark or do you think the prototyping means building an actual prototype, so to speak?

Mr. BATTISTA. Mr. Kennedy, it is a combination of both. Really this is the way the Navy used to do it years ago before their budget was cut back so drastically. I mean, you can capitalize now on your modeling. I mean, the virtual reality that you can do, the simulations that you can do, you combine those with test sites, land-based, you combine those with prototyping, and so I mean there is no rigid definition of this.

All we are suggesting is that you keep the door open and that you do whatever it takes. Now, in 1988 when we added the money in this committee to office budget, it was to actually build a revolutionary designed prototype submarine. It didn't have to be full scale. That is what we asked for. That is not what we got.

Mr. HUNTER. Let me just answer the gentleman. The committee's recommendation, the elaboration on our mark is operational prototype submarines. That is also with the understanding that this would, that you need the at-sea experience that is also the essence of Secretary of Defense Perry's statement, that is also the essence of Electric Boat's recommendation to the Navy.

What Dr. Foster said, and he can elaborate on that if you want him to is that there are other ways that you can prototype, quick prototyping you can do on shore, and you certainly need to do that at least to complement the construction of operational prototypes because you are going to have a lot of problems that you have got to fix before you get these babies in the water.

Mr. KENNEDY. All right.

Mr. Chairman, it seems to me the difference of opinion here is how to get a quieter, faster, more affordable, more effective submarine, so we ought to be debating how to do that because it seems to me that is understandably the difference in the various viewpoints of our panel here, and they are disagreeing, so we ought to understand the basis of disagreement, and it seems to me the heart of the basis of this disagreement is prototyping because that is the essence of what the chairman's mark includes, so I would like to hear how prototyping is either dated or it is relevant as opposed to trying to, for us as lay people, trying to understand between you, the difference between the *Severodvinsk* and the *Akula* class and how *Seawolf* matches up to that. That doesn't get us as a committee to where we need to go, and that is to decide where we go from here.

It seems the Navy has a plan that they would be willing to discuss. I, for one, hope that we take back from this discussion the notion that the Navy is not doing everything it can to get the best ship into the water because I have been disturbed to hear the questioning of the basic assumption that the Navy is not doing everything it can to employ the latest in technology, and I hear that over and over in the panel's testimony that essentially they are questioning the way the Navy employs technology and how they are behind the times and they aren't spending the money properly because I think if that is your charge, we as a committee need to investigate that because that is a pretty heavy charge when you think about the people who are responsible in the Navy for this program to wholesale question whether they are not doing what the best minds in the field think ought to be done. That is a pretty big question. That is why I would like us to focus on that.

Mr. HUNTER. If you want to ask, the essence of your question is the relevancy of prototyping today with respect to operational prototypes, which Mr. O'Rourke described and Mr. Foster obviously had a comment on. We will take this as your question since you arrived first, Mr. Kennedy, and gentlemen, go ahead and respond. Then we will go to Mr. Saxton.

Mr. FOSTER. Mr. Chairman, I think the fundamental issue that Mr. Kennedy is referring to is not quite so much a matter of prototypes as it is a matter of on the one hand in the time frame of 2020 needing a number of advanced submarines.

Now, the question is what qualities should they have? There are two ways to do it. One is to take the designs you have now and run a series of those, end up with producing 20, let's say. The other alternative is to say, no, we are concerned that the quality may not be high enough, and we would propose to use the next 10 years or so moving as quickly as we can from one generation to the next, to the next so that after 10 years, say, we might be in a position to have a very superior boat and then we will move to produce 20 of those. So it is a question of quality over quantity and at what time frame.

Mr. KENNEDY. And what is your difference with the Navy and its plan as you have heard it stated today?

Mr. FOSTER. My difference is I would prefer to take the next 10 years and do the best we can to advance the state of the art of submarines for the missions of the 21st century.

Mr. KENNEDY. I understand that. That is what the Navy wants to do. OK. Explain to me operationally what difference you have with the Navy's plan in new attack with the base submarine and the—as Admiral Frick has described, they are using that base to employ the latest in technology through a computer automated design system.

Mr. FOSTER. Well, look, frankly, I do not believe that the Navy's plan provides a sufficiently aggressive research and development program to make the new SSN advance as it is produced, advance with new versions at the rate that it is required. They will end up with the number of boats they produce. They will not be as advanced as the proposal that the special committee is advancing.

Mr. KENNEDY. How will that happen? Explain to me how—do you build prototypes? What I am trying to understand——

Mr. FOSTER. Simply, Mr. Kennedy, because as Mr. O'Rourke explained, there is one and a half, $1.6 billion more research and development money allocated in that proposal over the next 8 years.

Mr. BATTISTA. Mr. Kennedy, can I——

Mr. KENNEDY. You are talking about doing more research and development?

Mr. FOSTER. And applying it to the development of the boats.

Mr. KENNEDY. OK. And right now I would like to ask Admiral Frick if he would explain what the Navy is doing and if that differs from what you are asking us to consider.

Admiral FRICK. I think the problem I see is—and as I explained, I am the executor of the program—is that the prototype plan as presented, although we haven't seen the details of it, in my mind as the executor presents a major cost problem and perhaps a logistics nightmare for life cycles and support of the ship, yet we absolutely agree, and in the New Attack Submarine Program the whole concept has been to develop at first the most capable ship we can, but for the first time ever develop a submarine that is modular and can be effectively, cost-effectively and rapidly upgraded as technology comes along.

I am not an R&D technologist. I am not involved in that. I don't have control over that, but what we have taken, and we did it in our written report, was that technology that exists today or looks like it is going to be available for this ship, it is going on to the ship, if other technologies come along, that ship is ready to employ them, so my view of the prototyping is as that technology comes along, we get it in the ship as fast as we can because that is important. If the R&D initiative isn't good enough, that is a separate issue, and if that gets taken on and improved, then I have a platform that it can be incorporated in.

Mr. HUNTER. Just one point, Mr. Kennedy. The point that Mr. Foster made is if somebody is not making the technology come along by funding it, it ain't there. Is that right, Admiral?

Admiral FRICK. Yes, sir. You have got to get it out, the technology——

Mr. HUNTER. You have a modular sub without an R&D program to modulate?

Admiral FRICK. Yes, sir, and I have to say that is not my issue because I am the builder of ships and providing the platform to put the technology on. If this committee determines that there needs to be an upgrade in technology to help that out, then that is up to this committee.

Mr. KENNEDY. So, Mr. Chairman, I think we understand here what we need to do is invest in more R&D and give the Navy what it needs to employ the latest in technology because what the Navy's plan is is that it would incorporate the latest in technology, and that is what is—OK——

Mr. BATTISTA. Well, it is not that simple, Mr. Kennedy. For example, when you look at what the Russians have accomplished, I talked to them earlier about gas injection into the boundary layer.

Mr. KENNEDY. Well, let's talk about prototyping because I think that is the essence of the difference here. You disagree with their modular design build plan.

Mr. BATTISTA. No, I disagree with the fact that you can take technology and insert it at some later date. That is easier said than done. For example, you have a B–2 bomber that you are going to be voting on this afternoon. You can't take a B–52 bomber and make it stealthy. You have to design the B–2 bomber at the beginning with stealth characteristics. You had to know all the aspects of faceting, of how to make this thing stealthy, low, observable.

You can't take a submarine, no matter how modular it is, and say, by God, now I know how to do boundary layer control. I am going to incorporate that technology. I mean, all you do is take the nameplate, and that is all you can salvage, so what Dr. Foster and this panel is suggesting is that we pay attention to prototyping at this stage of the game, that we keep the options open.

The main difference here is if you approve the Navy's program, they commit to a New Attack Submarine, 1998, and then that is followed by a whole class of boats, and you are betting that you can insert technology. We are saying we are not willing to make that bet. We think you ought to build three or four or whatever it takes into a number of prototypes and then at that point say, OK, we have really explored the technology now, and now we are ready to move out. That is the major difference.

Mr. KENNEDY. Mr. Chairman, I just want to say I have gotten some initial briefs on the computer automated design and how effective that is in eliminating a lot of the problems up until this latest class of submarine in the cost of constructing a submarine, and essentially what I am hearing from all of you is let's build more hulls and incorporate the technology into each of those prototypes and that is how we arrive at the fastest, quietest, stealthiest sub at the end as opposed to building one hull and trying to modularly incorporate the latest in technology as the technology becomes available.

Essentially there is a major difference and schism between your approach, which is to build more hulls while you are incorporating those technologies into those new hulls versus having essentially one flexible design where you upgrade it with each generation of technology, and to me, that is the difference in night and day in terms of costs because if anybody has visited any of these shipyards, you know it is a big program to put, to see any of these ships with the technology you are talking about, and you are asking us to build each ship with the latest in technology so that we can test it while we are sending it to sea, and that is a pretty big difference in opinion.

Mr. BATTISTA. Well, that difference of opinion is based on the following, and this is not to embarrass anyone, but in 1980 this committee got into Soviet——

Mr. KENNEDY. Excuse me. The whole idea of us going to this new attack is so we wouldn't have to build as many boats because it is so costly when you are looking at the procurement of the heavy steel and the labor hours that go into building each and every one of these hulls. You are asking us to build 10 or 15 more hulls in between because you don't trust the new attack design and build approach to incorporate the differences in technology as they become available.

Mr. BATTISTA. Because some of them may not be able to be implemented in that period of time. Let me give you the genesis very briefly. This committee got into submarine hearings back in 1980. There has been a running difference of opinion with the Navy. Mr. Bateman, you were at that heated hearing before the Sea Power Subcommittee. We wanted to build this additional hull at that time. This was 1988. The Navy contended that the alpha was a 30-knot submarine. This committee said, no, it is 40. Who was right? It is not a question of being who was right and who was wrong.

Mr. KENNEDY. So you are saying build the ship to test it, the prototype.

Mr. BATTISTA. In 1988 we did that, and Mr. Bateman remembers, I believe you remember all of the photography that we showed you at the time, Mr. Sisisky was there I think Mr. Pickett was there as well, and we went through everything that the Russians had done, and I think there were a lot of open mouths at that hearing at that time.

Mr. KENNEDY. Mr. Battista, I would have no objection to building more hulls because I have a shipyard right near my district and it employs a lot of workers, so there is nothing more that I want than to take your approach because that means more jobs to my district because the more modular prototypes you build, the more people in my State are employed, so I just want to state for the record, Mr. Chairman, I am up here. My interest is getting more jobs for my district, if I want to buy on to Mr. Battista's approach, because to me, that will employ more people in my State.

Mr. BATTISTA. Let me just say that I recognize your need to satisfy your constituent interests, but in this particular case——

Mr. KENNEDY. I am just with a finite amount of dollars. We have already decided we can't do that. What we are trying to do is do the best with what we have got. You are essentially saying we don't have the best. What we need to do is spend more money, build more prototypes. I am with you, if that is essentially what you are saying, within a ceiling of dollars what is the best approach.

Mr. BATTISTA. That is the point I wanted to make. We are not asking you for unlimited dollars. We are just saying the investment is well worth the return. The return is assured naval undersea superiority that is owned by the United States.

Mr. WOOD. And it is cheaply purchased. The increment to purchase this has a top estimate of $8 billion. The buy of the New Attack Submarines has a minimum estimate of $50 billion. So you are talking about a 16-percent cost adder, as Mr. Battista said, to assure continuing American superiority undersea. Otherwise, not only is it at risk, but the hundreds of billions of dollars of surface assets are at risk as well.

Mr. HUNTER. I appreciate the gentleman and his questions and his interest and especially his district's interest. Let me recognize the gentleman from New Jersey, Mr. Saxton.

Let me ask Mr. Saxton to take the chair with his statement. I have to make a short statement on the floor, and I will be back shortly.

Mr. SAXTON [presiding]. Mr. Chairman, while you are on your way out of the room, let me just express the gratitude of all the committee members for the very thoughtful way that you have conducted this process, not just today, but throughout.

Mr. HUNTER. You are a great American.

Mr. SAXTON. Yes, I know, thanks. I think Mr. Kennedy did a very good job.

Incidentally, I am a long-time supporter of the committee position on this issue, so if my question makes it sound otherwise just be so advised.

Mr. Kennedy, I think, raised some very thought-provoking questions, and I guess I was going to ask a series of questions somewhat similar. Let me just do this and frame the question in a little bit different way.

I think what you will find is if there is anything left to be said, whoever wants to say it will be in a position to do so, but the Navy very articulately, I think, defended their position in saying that they began the process of design back in the 1980's, 6 or 7 years ago, and that as a result of all the research that has gone into the administration's program, that we would be in a position to build more subs sooner, presumably at less cost than we would.

And I think the thing that Mr. O'Rourke pointed out that our committee program over 8 years would cost something more, so we are looking at a more affordable program with the Navy and that they have designed their program to identify, analyze, and apply technology as it becomes available, and that through a variety of mechanisms there would be flexibility built into the Navy program, and you know, as you sit and listen to that, particularly given our position with regard to the budget and deficit matters that it does look rather appealing when all of that comes together and begins to look like a program that does make some sense, so I guess my question is a very general one if there is anything yet to be said as to why that is wrong.

Let me just use this opportunity to give you the opportunity to say whatever it is that remains to be said on this topic.

Mr. WOOD. A fundamental point, Mr. Chairman, is not that the Russian technology base is superior to the American one. It is inferior. It is not that the Russian submarine scientists and engineers and technologists are superior to American ones because they are not. They are somewhat more resolute and bold than we have been recently, but they are certainly not superior overall.

The basic difference, the reason for the situation that we currently find ourselves in, is we have systematically, seriously, and in a chronic fashion underinvested in the research and development necessary to leverage the American technology base into the attack submarine area, and that is the fundamental feature of the program from my standpoint: that the House now advocates a vigorous investment in R&D to bring the capabilities of the huge American technology base to bear on the attack submarine problem so that we not only retain superiority but that we increase the superiority which we have traditionally enjoyed in the first two or three decades of the 21st century.

This serious underinvestment through the present time has resulted in an inferior Russian technology base producing better Russian submarines. We need to fix that. We need to fix it fast, and in an enduring fashion and by a large factor. That is the nub of the problem, sir, I suggest.

Mr. SAXTON. OK, thank you very much. Let me ask one other question which is related, but certainly takes a little different direction. We have heard today and we know that our major competition with regard to submarines is from the former Soviet countries, particularly Russia. We are also watching as world events unfold; we are beginning to see that we have some other folks out there that didn't live behind the iron curtain and weren't part of the Soviet bloc.

I refer specifically to China, North Korea, Iran, maybe Syria. Can you enlighten the committee members as to whether there is a threat there that is related to the topic that we are discussing today?

Mr. BATTISTA. Well, first of all, Mr. Saxton, the Chinese are buying boats from Russia, submarines. That is worrisome. I believe they are buying better than the kind of submarine that ordinarily the Russians would not sell out of country. You are finding the Iranians owning kilos now; that was sold to them by the Russians. We have a formidable threat out there.

Lest there be any misunderstanding, there is no way I would trade our fleet for the Soviet fleet—in fact, any part of it. What I would like to trade is their seemingly unlimited budget for submarine development and technology. You know, there is no, I think, difference of opinion with regard to that at this table, even with the Navy. Our people are outstanding.

Some of our equipment is very outstanding, but it is worrisome. Basically, the main difference of opinion here is the Navy is saying we can get by with this one new design, and we are saying, no, we don't think you can on the basis of history, and we are saying you need more money and they are saying we can get by with what we have got.

I think when you look at the potential outcome it is a wise investment. We are talking about preserving the integrity of our fleet and being able to make this statement 20 years from now that there is no way we will trade anything in our fleet for what the Russians have, but I think at the rate they are going in submarine technology, it is of concern to me, and as I said earlier I think it is one of the three top priorities of this country. They are so much at risk.

Mr. SAXTON. Thank you very much. Mr. Peterson.

Mr. PETERSON. Thank you, Mr. Chairman. This has been an excellent process that we have gone through. I think at the onset I want to, and I can't speak for the Navy, but I want to say this. I can't, in my mind, have us walk out of this room suggesting that the U.S. Navy must abide an inferior product. I don't think that that is correct.

Mr. WOOD. Nobody is suggesting this.

Mr. PETERSON. These are operators. These are people who lay their lives on the line. They want the best. They want to build the best. Now, there may be a difference of opinion on what that best is, but if we as a committee, Mr. Chairman, wish to give the Navy more money, I have no doubt in my mind they will take it.

What we challenged them with, though, before ever arriving at this point, was—is that they had a finite amount of money. Suddenly, as this briefing began, they ended up with the option of taking $8 billion more or not. I think I can speak for the Navy. They will take the $8 billion.

But we have to say, first of all, is this going to be spent in a way that will ultimately give them a better product?

Now in my view, having listened to everybody and having some knowledge of how military systems are constructed, the New Attack Submarine is indeed a prototype in itself, an operational prototype. It is going to be built, one. We are not going to build 30 of these babies in the first 2 years.

As you—Mr. Battista had an analogy. The B–52 doesn't look at all like it did when it was first built. Each succeeding model picked up a new technology, and it has lasted for 40 years.

So I think we need to go back to what Mr. Kennedy was talking about. What is prototyping? I think the actual Navy plan is, in fact, a prototype. And now if we wish to engage—what we are trying to do now is, if we want to build 2 or 3 then we are probably going to build them off of a hull that is very similar to what they are building.

My question here is—well, there are several, actually. I could go on. This thing has got me riled up. I have an idea the Russians will sell us what we want. I have been working with the Russians for the last several years. I think we can go buy whatever technology we want. If in fact they are so damned good, as has been said here, if their product is so wonderful, I think they will sell it to us. And you have been talking to them, and I suspect you would agree.

Mr. POLMAR. Yes, sir.

Mr. PETERSON. So we are at a point now where we can take another jump, and that is what the committee wants us to do. But if it is R&D we want, then let's fund R&D. But let's don't delay the development of a system that clearly we need.

Now, I know at some juncture—and you in your written statement, Mr. Battista, you bought a computer, a Pentium 90. Now, there were people that could have waited for that computer that you bought and the subsequent 125 or whatever it is. But they would never have accomplished anything in that there is a year delay of waiting for that computer.

Computer technology has changed dramatically, as have the technologies you are talking about. So you can't wait for a new technology to start with, using the technology you currently have. I just don't think that that is rational. If you wait until a new telephone is developed, you won't be able to take the calls that are coming in today. It is that simple.

So I would like to know frankly—and I don't think the differences at this table are so wide as you all wish to make them. I think we have a prototype, and I would like to know if you all would agree with that, in fact with the Navy's plan.

And then I would like to know, Mr. O'Rourke, if you could take this prototype and use it as the test vehicle. And if we roll in $8 billion more in R&D, and given the modular design it already has and the fact that we are going to build subsequent ships, we are not building all the hulls at one time, why we can't add the new technologies as they go through? I don't understand the differences here. I think we are creating a difference where none exists. It is a vast argument, but I think we are overstating the problem.

Mr. POLMAR. I think there may be a semantic problem. The Navy, from what I have been told, briefed 2 days ago by the CNO, Admiral Boorda, on this, we are talking about the Navy program, not a prototype as much as a lead ship. You build the New Attack Submarine, fund it in 1998, and you build 2 years later two more, then two more in the same envelope.

If you come across a new piece of electronic gear, you plug that in. If you come across a new periscope, you plug that in, which we do in submarines.

Tony, I think the analogy to aircraft is very poor. A prototype is one where you go out on a limb, as opposed to a lead ship of a class, and you say I am going to build 1 or 2 of these to see if the concept works. We have done that in the past.

For example, we built one two-reactor submarine in our history, the *Trident*. There was never any intention of building a class of these.

Electric Boat built one gigantic two-reactor nuclear sub, the only two-reactor sub ever built in the West, to look at in the environment the two-reactor concept, which proved it out not for submarines but for surface ships.

We built a very small nuclear submarine, designed at 1,000 tons, came in many hundreds of tons more, the *Tullibee*.

We built one submarine to test a new type of quiet reactor, a new type of sonar, which became the VQQ–2, which we have in most of our subs today. We built one. She had a lot of problems but she gave us automation to the extent that we have it in our Navy. She gave us a new sonar, amidships torpedo tubes. We only built one.

And there is no other submarine in the world that looks like the *Trident*, no other American sub that looks like the *Tullibee*.

We did the same thing with the *Narwhal*. We built one submarine with a natural circulation plant. The rest of the sub looked pretty much like other SSN's, but we built just one and used that technology in different hulls later on, including new *Trident* submarines.

So what the Navy is looking at is a lead ship. You build 1 and then you build 20 or 30 more of those envelopes over the next 10 years and you make changes within them. But by locking yourself into the exact hull, basic power plant, propulsor, propeller or shrouded propeller, number of torpedo tubes you don't change those things as time goes on. Prototypes as we are discussing are two or three or four very radically different basic designs.

Mr. BATTISTA. May I take the analogy that you extracted from me on the B–52?

When we built the B–52 we had an awareness of stealth technology. We knew about stealth when we built the SR–71. You are right. It would have been a serious mistake for us to say let's not build a new bomber because we know about stealth technology, because it was not ready.

But the main difference here is that we have watched the Russians in their environmental programs and their R&D programs demonstrate technology that is ahead of ours. And you are right. We can probably buy it from them now, but we are not doing that.

I have to ask you to go back in time and say at the time we bought the B–52 would we have bought it if we knew the Russians had already demonstrated a B–2-like capability back then? I don't think so. I think we would have said, let's have an accelerated program, and let's get on with it.

Mr. PETERSON. That is my point. I think that is a step beyond where we are. I don't think that the differences are B–2 to B–52.

Mr. BATTISTA. Oh, they are.

Mr. PETERSON. If they are, then we must go buy that technology from them.

Mr. BATTISTA. I would love to.

Mr. PETERSON. If you believe that, I think we would allocate the funds to do that, because that is suggesting that it is such a leap that we cannot catch up.

Mr. BATTISTA. Talk to Mr. Bateman. I left those photographs with the committee when I retired from here.

Mr. Bateman, were you at all shocked at those capabilities back then? You certainly created the impression that you were back in that closed hearing.

Mr. BATEMAN. Your memory is always a lot better, as is most people's, than mine. I can agree that from hearings—and there were joint hearings of the Seapower Subcommittee and the R&D Committee—that many of us became genuinely concerned that we were not pursuing antisubmarine or undersea warfare technology as vigorously as we should. I distinctly remember being a part of the effort that essentially salvaged the then *Seawolf* program as the Navy's ongoing solution to undersea warfare but on condition that some $100 million or some such sum of money be made available for advanced submarine technology.

I would applaud you today as I did then for making the Navy and making this committee aware of the fact that we can't be relenting in our pursuit of excellence in undersea warfare. I am disturbed at the prospect that we are not maintaining that capability which the Navy has always, at least in my discussions with the Navy, assigned a top priority to.

Going perhaps much further than your question of me suggests, I want very much to see this country catch up and to stay ahead in undersea warfare. I think this committee has a responsibility to make money available to see that we do pursue it.

The problem I have is that if we haven't done things over the last 5 or more years that we should have done, maybe that remains very unfortunate, but crying over that spilt milk is not the solution; and perhaps we cannot get, in view of what we haven't done for 5 years, everything that we ought to have had. We aren't where we would like to be.

But we also have to be concerned about the fiscal realities, the budgetary realities we are dealing with, and whether or not and at what point we are going to be able to start putting submarines in the water that are as good as we can get as of the point in time when we conclude we have to have new submarines going into the water.

I don't know where you draw the line between freezing a design and technology that is known and getting about building something and hoping that as new technology becomes available we can retrofit it into a platform, as opposed to the point in time when you say the technology is so limited, so inadequate that we shouldn't have a platform yet. We should wait for further developments of the technology. Frankly, I don't consider myself sufficiently expert to know the precise point where you make one tradeoff to the other.

If the burden which you are telling me—and I am not a member of this subcommittee but very interested in the subject—is that we need better more robust research to advance our undersea warfare capabilities, I would certainly applaud it; and I applaud the chairman of the subcommittee for recognizing the need and seeking to address it.

Mr. SAXTON. Would the gentleman yield for two points here?

No. 1, we have a vote. The chairman is back. He has a brief comment that he would like to make. We will go to Dr. Wood, who has a comment that he would like to make; and then we will vote. And I would suggest that when we come back we operate under the 5-minute rule so that everyone here has an opportunity to ask a question. Mr. Chairman.

Mr. HUNTER. Thank you. I have to go be on the floor over the next 15 minutes or so.

One point made in the meeting with the Speaker and with Admiral DeMars last night was the admiral's feeling that our panelists needed an in-depth briefing on NAS, the New Attack Submarine. We have charged them with receiving that briefing. And I understand, Admiral Frick, you are going to see to it, and Admiral Jones, that they will be accommodated. Is that accurate?

Admiral FRICK. We have always been very open. This is probably the most open program in the Government today. We are more than willing.

Mr. HUNTER. This isn't just openness. This is active accommodation so that our panelists can be intimately acquainted with NAS.

Admiral FRICK. We will give deep discussions at whatever level they want to go to.

Mr. HUNTER. Thank you. Thank you for bearing with us and undertaking some very long questions.

Mr. SAXTON. We are going to recess. I thought Dr. Wood had a comment, but I think he may have yielded to Mr. O'Rourke.

Mr. WOOD. I yield part of my time.

Mr. SAXTON. We will hear this comment and rush over and vote. Mr. O'Rourke.

Mr. O'ROURKE. Representative Peterson directed part of his inquiry to me. I feel I need to put the response into that part of his question.

He wanted to know if the New Attack Submarine could be used as the test bed, as the prototype. You can prototype at different levels—at the component level, system level, modular level, at the whole platform level; and the witnesses have various views on that. The program that I costed out and which I presented to you earlier prototypes at the whole ship level, and it contemplates using the New Attack Submarine as the baseline design into which the new technologies would be injected. But those technologies would be injected more quickly and more aggressively than under the Navy's plan.

So when Mr. Peterson says can we use a New Attack Submarine as a test bed, the answer is that is the test bed plan that we tested out.

Mr. WOOD. If I could respond to some of the inquiries, I don't think there is any doubt that any member of the panel has a very high regard for the confidence and professionalism of not only the two Navy admirals here but of all of those who work on the New Attack Submarine program.

The fundamental critique of the subcommittee that I believe that all of us are here to speak in support of this morning is that the Navy wants the best submarine that they can buy immediately. That is the point of departure.

Our fundamental critique of the Navy position is that the R&D Program over the past decade has not positioned them to buy a really high quality submarine immediately. The R&D Program which is proposed is not an $8 billion one, as suggested. That is only one ship, the $1.6 billion as Mr. O'Rourke pointed out. The other 80 percent of the $8 billion program is for the creation of the half dozen operational prototypes to express the new R&D technology in prototypes, to evaluate its performance. And it is that demonstrated operationally evaluated performance that we feel is essential to have in hand before the New Attack Submarine program actually started laying down keels.

Thank you.

Mr. SAXTON. We will recess at this time. This is the vote on the B–2, so we will be back in 10 or 15 minutes.

[Recess.]

Mr. SAXTON. Why don't we try to get started? We have several members who have not returned yet, but it would be the Chair's intention certainly to recognize them when and if they do. In the meantime, we are going to call on Mr. Torkildsen, the gentleman from Massachusetts, for his questions.

Mr. TORKILDSEN. My first question was for Dr. Foster.

Mr. WOOD. He had to leave for a plane during the recess.

Mr. TORKILDSEN. Mr. Chairman, I would like to read my question into the record, and if we could have him respond later that would be appreciated.

For the record, my question for Dr. Foster was that in his testimony he recommended the use of rapid prototyping, and I was concerned about the cost. I wanted to ask what type of estimates he might have about rapid prototyping and the operational prototypes that he envisioned and if he had considered any extra cost that one-of-a-kinds had acquired over their lifetime.

I think those questions are important for this committee to make a recommendation to the full committee and to the full House.

Admiral Frick, could you talk about what the Navy position on rapid prototyping or operational prototypes are and are they affordable within the R&D outyear budget estimates that you know of at this time?

Admiral FRICK. I am not an R&D expert. I am an acquisition expert. But I can tell you that tying rapid prototyping or prototyping to a combat or ship acquisition program does create some significant cost problems and some significant logistics problems through the life cycle of the ship.

Rapid prototyping, other than a ship prototype, subsystems, subcomponents is a very good way of getting things onto ships. As a matter of fact, we are doing that now.

To give an example, the reverse osmosis desalination system is currently being installed on a 688 class submarine, what we would call an advance technology, so we could no longer have to use steam to create pure water for both the ship and the propulsion plant. That has been rapidly prototyped in less than a year to build that and install it so we can test that at sea on other ships, prove it and then put it on a New Attack Submarine. Then it becomes cost effective.

If you want to hold up a ship or try to rapid prototype a ship, there is no short term or rapid prototyping of a ship.

Mr. TORKILDSEN. Thank you.

For Admiral Jones—I guess this goes to the heart of the debate—why is the approval of the third and final *Seawolf* critical to the Navy's submarine modernization plan? Could the Navy acquire the advance capabilities of a New Attack Submarine in a cost-effective manner without first developing and deploying this final *Seawolf*?

Admiral JONES. That is an issue that has been missed, the operator's point of view on this. We need good submarines now, and we need good submarines in the future, and we can't wait. Mr. Peterson brilliantly said you could wait forever for computers to come, but in the meantime you would do nothing.

The *Seawolf* is the finest submarine in the world. It is just too expensive, and we have to move on. The *Seawolf* is the quickest way, from an operational standpoint, that we can get three very good submarines to sea. We can't be ready to build the New Attack Submarine until 1998. I am not a builder of submarines, but I am convinced that you cannot build it sooner. So, therefore, we need that in order to get something out there as soon as we can while we are designing for the next generation.

I think a couple of things need to be stated also.

First, it has been stated here that the Russians are superior to us; and that is, in fact, a falsehood. The Russians are, in fact, doing things faster than we expected them to, and in some areas they do things better; but, overall, they are not superior to the submarine force that you have at sea today. However, we have to prepare for the future also.

Second, I think is that the plan that the Navy has is not only to put the best ship out there but to put a ship out there in accordance with the Navy's recapitalization program so that we not only have a submarine force today but in the future, and we have to do that in a fiscally responsible way. We are only given a certain amount of money, and we understand that.

It has also been asserted here that this submarine has reduced capabilities. I don't agree. I think this submarine has been optimized where it is going to have to spend the major part of its life, and that is in the littoral.

For those people who say it has a reduced weapons combat system, I would tell you the torpedo room may be a little smaller, but we put VLS back on so now we have 12 external tubes outside that weren't on the *Seawolf*.

For people who say it is smaller, it must have less in it, I would say to you that it is a phenomenal ship designed for special operating forces because it now has this huge torpedo room that is not being used for torpedoes.

Additionally, it will carry the swimmer delivery vehicle system that the SEAL's use. I would also tell you that it is a ship designed to operate better in shallow water because it has better depth control.

So this is not a ship designed such that it has lost capability. It has been optimized.

One of the final things that we need to talk about is that, as I listen to this discussion from an operator's standpoint, the United States of America is getting a good deal here. This is, we have our cake and eat it, too.

I said we need the ship today. It will have the finest technology this country has today infused in that ship. However, the way we are building it, which in itself is very unique, will allow us to insert any kind of technology that comes available in the future. I think that is great. Because I get a good ship today, I get a good ship in the future, and the sailors that we put out there have the same capabilities that I was allowed to have when I was a young guy.

I just—I am having a little trouble understanding. I think Mr. Peterson said it better than I could. This is a perfect match for what we are trying to do within the fiscal constraints that we have been asked to do it in.

Mr. TORKILDSEN. Thank you.

You have brought up a number of valid points to this debate. One area, if you could, to expand a little more over and above the operator's perspective in this, which is extremely important, is walk us through what you would see as an alternative scenario where you see this as going into a third *Seawolf* being the best of both worlds leading to the new prototype submarine. What would you see as the downside if we did not have that leeway into the New Attack Submarine that is needed?

Admiral JONES. I am not sure I understand the question, sir.

Mr. TORKILDSEN. I am sort of asking you if we did not have this, if we had to go directly to the New Attack Submarine from where we are now in terms of everything that is out there, in terms of ability to produce it and what you know—I mean, is this simply a debate over rapid prototyping versus traditional process or are there other factors involved? If you say you don't see a distinction between the two, that is fine as an answer.

Admiral JONES. The *Seawolf* has been—even though it is the finest submarine in the world, but it is too expensive and we need to move on—has been a very, very crucial learning experience to industry as well as to the Navy. We have learned how to do things so much better in building that ship that will save money for the country as well as give us a better product when we finally get into construction of the New Attack Submarine.

Seawolf is also a ship that, no matter what it was primarily designed for, is going to be very, very effective in just the shallow water. So it is a stepping stone not only industrially but it is a stepping stone operationally.

Mr. TORKILDSEN. Thank you, Mr. Chairman. I thank the witnesses for their testimony and you for holding this hearing and yield back the balance of my time.

Mr. HUNTER [presiding]. The gentleman from Maine, Mr. Longley.

Mr. LONGLEY. I just would like to echo comments made earlier by Mr. Kennedy that a number of the charges that are being made today I view as extremely serious and to the extent that we need to schedule a full hearing or a closed hearing at a later date to get into some of these details I think would be most appropriate for this committee. It is clear to me that some very, very serious statements are being made that need to be examined fully.

Having said that, I would like to also pick up on the issue of semantics and make sure that we are all speaking the same language. Mr. Battista, you commented that what you are really saying is that you would like to build a number of different hulls or are you talking about the same hull and different components?

Mr. BATTISTA. I am suggesting that we build several hulls in conjunction with a land-based development site and that we really explore all these options. Because I think there is a terrible misconception here about the ease in inserting new technology into a submarine. If you want to insert a new software package, that is easy to do; but if you are going to insert a radical new technology that we know that the Soviets have already demonstrated at sea, it is like taking a nameplate and putting a whole new platform under it. I suggest that you not commit to a class of submarine at this stage of the game. I fully endorse the committee's position to build several different hulls designed——

Mr. LONGLEY. You are talking about——

Mr. BATTISTA. Newport News and Electric Boat.

Mr. LONGLEY. You are saying that these would be different hulls built successively over a period of 8 or 10 years?

Mr. BATTISTA. I think we can do it sooner than that. I think a lot of these things can occur in parallel, not serially especially, if you have two yards, Newport News still in the business. Whoever came up with the idea to get down to one yard had his or her head in the sand. That is the worst thing we can do at this stage of the game.

Mr. LONGLEY. Let's get to the basics. The money just isn't there to build a couple of different hulls simultaneously.

Mr. BATTISTA. People keep saying the money isn't there. I can give you a clear example of a service that is spending $161 million in 1 year on a weapon system that clearly doesn't work. It works so badly that it has been grounded. And yet nobody in DOD goes after that $161 million.

Mr. LONGLEY. I don't want to get off on that tangent. I have read your clip, and I understand you have strong feelings about a number of weapon systems. I am concerned with getting to the question of the prototype.

Admiral Frick, in your opinion if the New Attack Submarine is delayed to move into some type of a prototype program, do you see that as gaining time to complete new technologies? How do you view the issue of integrating new technology with the submarine program?

Admiral FRICK. My view is that R&D is going to continue. It may or may not be underfunded, but it is going to continue.

If we wait for an additional 5 years or industry to then force that technology so that we can build several prototype ships, two, three, four, five that are different, then we have created, I believe, as the guy who is personally responsible to the taxpayer for spending the money correctly and efficiently, that we have created a cost nightmare. We are going to have multitudes of problems where we end up scrapping projects, ships.

And I see a plan that is moderately funded or estimated at about $8 billion when, in fact, I think that is low by maybe half. That comes from the experience of building ships. I am not an old hand at this. I drove ships for 21 years, but I have been building them for 5.

I have gotten into a lot of detail about how you design and build submarines. The submarine is the most complex weapons platform in the world. The U.S. submarine is clearly the most complex. This is not something you do rapidly, not something you do in a year or 2 or 3 years. That is why we went to the New Attack Submarine concept of establishing a platform that was flexible enough to allow quick insertion of new technology.

And these aren't just boards. When I need to upgrade that combat system, instead of gutting the front end of the ship I can take off the shelf technology in whatever kind of processing or visual imaging or processing throughput, and I can now insert it rapidly without changing the structure of the ship. That is what drives that cost.

Mr. LONGLEY. Get to the bottom line of the contention being offered here. Are you aware of any new technology that in your opinion would warrant delay of the New Attack Submarine?

Admiral FRICK. No, sir. We did a scrub of that to see if there was new technology, and there is none today.

Mr. LONGLEY. Have you evaluated the technologies that have been testified to here?

Admiral FRICK. Yes, sir. Those technologies have been looked at, and they are not ready to be employed. It wouldn't be responsible for our part to try to take a high risk. *Seawolf* was the state-of-the-art technology, and it costs a lot of money. Nobody can tell me that we could have done that cheaper, even without the truncated program to drive those costs down, and it would have been driven it down if we had done 30, but that technology costs a lot of money.

The New Attack Submarine—we are taking all the lessons learned so that we don't do this very, very expensive military specification ship. We are doing a performance specification and allowing the best capability in the United States today to come back and tell us what the combat system ought to be, and they are going to be able to do it cheaply.

Mr. HUNTER. Would the gentleman yield? Because I think in the question there is a misconception. Maybe Mr. O'Rourke can clear that up in his analysis.

But our plan has continued procurement of the first boat of the so-called New Attack Submarine series. That hasn't been altered. So we are not delaying the construction of what you call the New Attack Submarine. We are saying we don't think it is the best it can be, and we are going to build and allow the competitors to build operational prototypes that will give you over the next eight years just as many ships as your plan gives you, but you are not locked into a 20- or 30-ship cycle. So that if the *Papa-9* furnishes out to be better or as good as a New Attack Submarine we aren't married to a 15- or 20-ship class.

What objections would you have if you are getting the New Attack Submarine—you can call it the New Attack Submarine, and that would be procured at Electric Boat. What objections would you have to the shouldering of some new technologies and the development of that technology by additional dollars in R&D?

Because Dr. Foster pointed out we don't have funding to produce the technologies we want to put in these boats. That is one reason there is not a lot left laying around. Do you understand that under the plan we have you would receive that first boat on schedule? You wouldn't delay that?

Admiral FRICK. The issue is not with the first ship but if we are going to do hull prototypes with follow-on ships. Those are not similar ships. Those are major design reconfigurations, and they are not easy. They are not 1- and 2-year jobs.

Right now, we have stressed through the design build process the design capability of Electric Boat to the limit, and they have achieved tremendous success and advances in that technology. So if we are going to do hull prototypes, we agree technology is important, and we need to march on, and we need to incorporate technology. But if we do hull changes, that is not easily done, and that is almost an entire ship redesign. That is my concern as the executor of the program.

Mr. LONGLEY. Admiral Jones, how would you define the state of submarine warfare today? Is the emphasis antisubmarine warfare? Are there other interests or priorities that are now entering into the equation?

Admiral JONES. You are aware we have always designed attack submarines to be multipurpose platforms. They have always been able to do many, many things. In fact, I have trouble figuring out any other military platform that does as many things as we ask submarines to do. And that is good, because we get our money's worth out of them.

During the cold war, we spent a lot of time doing ASW, and that was proper. When the Wall came down and people believed that ASW was not as high a priority, that gave us the opportunity to rearrange our priorities, if you will, intelligence gathering, reconnaissance, working with the SEAL's, mine warfare, missiles, et cetera. We had always done all those in the past. However, ASW was No. 1.

We continue to do all of these things and continue to excel at them and the folks are doing a fine job, but ASW is not the only mission we have. But ASW today, the bottom line may be that it is more difficult than it was before the Wall came down because now we have to worry about not only deep water ASW but also shallow water ASW, and that is a very big challenge as you get into noisy shallow water looking for a very quiet diesel submarine.

So if the question is how is the submarine force doing, we are awful busy. In fact, the point can be made that the submarine force is doing more operationally than they were before the Wall came down, and the number of ships is coming down with it. That is thought provoking when you think about the future.

We are doing ASW. ASW is very, very important. It is a very perishable capability, one that not only the submarine force is involved in but the aviation community and the surface community, and you must practice to be good. It is one of the arrows in our quiver.

Mr. LONGLEY. Mr. Polmar, a follow-up question. In your studies does the Soviet or the former Soviet Union, the Russian approach to missions, does it parallel ours or is it radically different?

Mr. POLMAR. It is not radically different but it is different in that they do not look at the expeditionary nature of naval forces the way we do to operate in forward and shallow areas to support activities ashore. Theirs is more denying us the ability to do that, for example, as far as forward operations in littoral areas, to use a current jargon. Open ocean ASW, certainly the same as ours. Strategic deterrent, even more emphasis today than we have, possibly.

As far as protecting their strategic submarines, the same as ours. There are some parallels, but they are less concerned with the forward or expeditionary nature of operations and, hence, they don't look at that as a major role for their submarines.

Mr. LONGLEY. Dr. Wood, I note you are with the Hoover Institution at Stanford. Mr. Battista and Mr. Polmar, do you work for yourselves?

Mr. BATTISTA. I don't work for anybody on submarines. I am retired from this committee. I am on the board of directors of one company that has nothing to do with submarines. I am here because the chairman extended me an invitation.

Mr. WOOD. I consult to several people in the U.S. Navy, none involved directly with submarines. I consult to a couple of companies, none directly involved with submarines in this country. And I do quite a bit of writing both regularly for the Naval Institute Proceedings and other journals as well as books.

Mr. BATTISTA. Mr. Longley, could I take a moment to say that I have to express disagreement with the fact that if we had to do the *Seawolf* we couldn't have gotten the costs down? Let me say that we were well aware of open architecture when the *Seawolf* was started we didn't do it. Let me say that we were developing an enhanced modular signal fuel processor at the time. This is a big number cruncher. There were commercial equivalents out there, and we didn't capitalize on that. I can list system by system——

Mr. LONGLEY. That goes back to my comment that I think this committee may need to have a follow-up hearing, maybe a closed session in terms of the allegations of not only the qualitative differences and deficiencies, but also the surprises that we have experienced—and as a new member of this committee I would be interested in having a better sense of the history of how effectively we have monitored some of these issues over the past decade.

Mr. POLMAR. Mr. Chairman, I would like to raise questions about a couple of the statements that have been made in the last few minutes to show on the record that there is some degree of disagreement. We were just told, for example, you cannot do a new submarine. It is something you don't do in a year or two or three.

I would submit if we read history, we did that in 2, 3, and 4 years in the United States in the 1950's when we took the Polaris program; and within a very short number of years, building on existing technology, we built a new submarine in that time period.

It had a totally new missile system. We added 180 feet of length to the submarine, which greatly affected hydrodynamics and weights, a navigation system that did not exist the day the program was approved, an atmospheric control system which did not exist the day the program was approved, a fire control system which did not exist the day the program was approved.

We did that with less computer-aided design and less other support than is available to ship design today. We were able to take technologies which were not mature but we knew they were out there, and within a period of 3, 4, max of 5 years we deployed the first boat 5 years after the program was approved, or less than that.

We were told that we learned so much in how to build that ship over the last 10 years, referring to the *Seawolf*. If we learned so much in construction techniques, have we learned nothing in design in those 10 years?

We were told, "The new attack sub has reduced capabilities. I don't agree with that."

"The New Attack Submarine will carry 37 weapons." Two years ago, I sat in the back of this committee room and heard Admiral DeMars and Admiral Ryan explaining why we needed *Seawolf* with 50 weapons because 37 weapons in a *Los Angeles* class submarine were no longer acceptable.

We were just told, "I can insert any kind of technology available in the future" in the New Attack Submarine. I am sure the 4 of us sitting here can come up with a list of 20, 30, 40 technologies that are either in Russian submarines or we are spending money on for future application for undersea warfare which will not be insertable into the envelope of the lead ship New Attack Submarine.

Mr. WOOD. If I could clarify a couple of points.

I think Mr. Polmar did a masterful job of eliminating some of the misunderstandings that might have arisen from previous testimony. I am here as a private citizen today as an invitee of the chairman, not as a representative of the Hoover Institution.

The point with respect to the nonavailability of funds and the large costs of the program under discussion, et cetera, I think should be seen in perspective. The $8 billion delta which the committee proposal contemplates which results in a minimum of six operational prototype submarines is not an inconsequential amount of money, and I don't think anybody here would say that you just bandy about those sort of sums.

However, as I said relative to the estimated cost of the 30 boats of the New Attack Submarine program, it is only 16 percent and it is not spent on R&D. Only a fifth is spent on R&D. Four-fifths of that $8 billion is spent on a delta to produce the operational prototypes.

To put this in context, during the last year alone the cost of the New Attack Submarine has grown by approximately 10 percent or $5 billion. This doesn't show in the record because they are still paid at a unit cost average of $1.5 billion. However, that $1.5 billion last year was fiscal year 1998 dollars. This year it is fiscal year 1995 dollars. That is about a 10-percent cost growth in 1 year.

So when you look at these amounts, you need to realize that though people may in all candor and with the best intentions give you cost estimates, that they are very fluid and subject to change and they usually change in the wrong direction.

Mr. HUNTER. We have a vote on. It is the F–22 vote. We have 4½ minutes. We will back with Mr. O'Rourke making a comment. We will recess briefly if we could.

[Recess.]

Mr. HUNTER. Well, gentlemen, thank you for your testimony. Jim, did you have anything further you wanted to add?

Mr. LONGLEY. No, thank you, Mr. Chairman.

Mr. HUNTER. Thank you so much for being with us today. Oh, yes, Ron O'Rourke, you were going to give us a little——

Mr. O'ROURKE. Right, I wanted to add one clarifying point that goes back to a comment made earlier about the cost of the effort and the $8 billion estimate that was thrown out. There was a remark that it might wind up costing roughly twice that much.

I think it is very important to know that among the civilian witnesses here today we have received somewhat differing visions of what a prototyping effort can be, and some of those visions are less expensive and some of them are more expensive.

Now, I costed out for you the particular vision that your subcommittee has worked up, and I do believe it to be a fair cost estimate. I would have no problems structuring a program that would cost twice as much. If you wanted to structure something that would cost $16 billion, yes, I could do that, too. If you want to structure a program that costs only $4 billion, I could do that, too.

Some are more aggressive and more extensive visions of prototyping. Some are less, but I want to be very clear that in my view, the $8 billion estimate is a fair estimate for the particular version of the prototyping effort that you asked me to cost out.

Mr. HUNTER. OK. Thank you, Mr. O'Rourke. You might elaborate just briefly for Admiral Frick's edification the sibling nature of the prototypes and the operational value of the prototypes and the reason you need a number of them rather than one or two to shoulder the new technologies.

Mr. O'ROURKE. Right. Well, I guess what I can do is reiterate what I had said earlier in my opening statement, which is that under the committee's version of the prototyping effort, which is not necessarily the same as what we are hearing from some of the witnesses today, the first operational prototype which would be funded in fiscal 1998 would be the Navy's New Attack Submarine design or something very close to it.

Each subsequent operational prototype would incorporate a different package of advanced technologies. That is not too different from what the Navy is proposing. The result would be a group of sibling submarines, submarines that would be very similar to one another and to the New Attack Submarine design except for the differing packages of advanced technologies that they each incorporated.

The difference between the Navy's baseline plan and what the subcommittee has developed as an option is that under the subcommittee's option the new technologies would be injected into the baseline New Attack Submarine design sooner, the technology packages that are injected would be somewhat larger in scope than what the Navy has in mind, technology packages would be somewhat more experimental and developmental in nature than what the Navy has in mind, and fourthly, that the subcommittee's plan would follow this up eventually with the starting of series procurement of a drew, different submarine design, a next-generation submarine design.

Mr. HUNTER. Why don't you hold on that point for a second because, Admiral Frick, you mentioned kind of in a blase way that you didn't want to have this nightmare of hodgepodge submarines with all these technologies to surface and these big logistical problems. But you are talking about inserting new technology in the New Attack Submarine, so you are going to have—you are not going to have cookie-cutter submarines if you evolve the new attack submarines, are you?

Admiral FRICK. No, sir. I think maybe the fact that we don't have—I have to deal in detail acquisition or design requirements and proceed with that. When we do changes and the plan for the New Attack Submarine change is that the current plan today is that when there is that proven technology, and if we prototype it we probably prototype it somewhere else, either land-based, as Dr. Foster had mentioned or on other submarines. Then it becomes a class change, and we do that.

In the New Attack Submarine, the difference is that we intend to have, hopefully, major upgrades in capability at low cost, and it becomes part of the plan.

Mr. HUNTER. So what happens? You may say it is part of the plan, but in reality you are building these babies at one every year or couple of years, so you are not going to have 30 off the bat. If you come up with a new technology in 3 or 5 or 6 years, you are not going to have 30 NAS submarines to put these in. You are going to have a couple, right? So you are going to have a couple of submarines in your entire fleet driving around the ocean with this new technology; is that right?

Admiral FRICK. There may be a short period of time where there is a couple, but not for the life of the ship. We do that today.

Mr. HUNTER. Wait a second. Explain for me, then, you have got a couple of New Attack Submarines in the water. You have got a new technology you want to stick in. So you bring them in at convenience, on availability and you put in the new technology. Now, why is that fine and yet putting new technology in three or four prototypes is mission impossible and a nightmare?

Admiral FRICK. I think it perhaps would have to get down to the details of what that entails, and is it affordable.

Mr. HUNTER. You don't even know what it is right now, right?

Admiral FRICK. The technology that is available and ready to insert is already going into that lead ship. Now, if in the next 5 years there is more technology in the combat systems area that will be refreshed, as I said in the year 2003 as the ship goes to sea, that is in the contract and that is paid for.

Mr. HUNTER. Right, but you don't know what new technologies will be developed over the years or mature to the point where you want to put them in a ship, so the point is you are going to have pieces of new technology that have to be inserted in ships where you have got, of your entire submarine fleet, you are going to have at various times one or two ships that may have that new package in them, right? Is that right?

Admiral FRICK. Yes, sir. But I think the difference is we are coming up with a plan that directs technology insertion of specific items that are not available today, and so we are going to try to drive that R&D train from a procurement perspective. My view is that——

Mr. HUNTER. Where are you going to get the money to do the R&D to get these new things?

Admiral FRICK. That is in the current R&D program. It is laid out in my testimony what is there, what is coming up what is going in now and what is not going in.

Mr. HUNTER. On that point, you said, and I have got a memo here, it is September 6 this was received by us from the Navy, practicalities of scale and the scope of the engineering challenges have eliminated consideration of the electric drive propulsion mode from future submarine designs. We got that, I think, yesterday.

Now, in the meeting we had with Admiral DeMars and you last night, you brought this up as electric drive is a real potential.

Admiral FRICK. Admiral DeMars did, yes, sir.

Mr. HUNTER. OK. Well, now, it doesn't look to me like you folks are singing off the same sheet as to exactly what is possible to put in. It is mission impossible here and it is a real possibility last night.

Admiral FRICK. To date the information——

Mr. HUNTER. At least 3 hours difference in your statement.

Admiral FRICK. To date the information we have, and Admiral DeMars said this last night, too, is that we are going to continue to look at electric drive, but he doesn't think it is going to work right now. We don't think that the scale up issue is going to happen, at least not in the next few years.

Mr. HUNTER. OK, question, if you could put something like electric drive in a prototype where you didn't prejudice the success of an entire class of boats, why not do it?

Admiral FRICK. If we could prototype it in a smaller scale vehicle and prove it, that would be cost effective to the taxpayer, then upscale it, prove it on a prototype. We need to get it working first.

Mr. HUNTER. You would like that?

Admiral FRICK. If it would work. It is not available. It doesn't work right now. That is the problem. Now, it may happen in the next 5 years.

Mr. HUNTER. OK. But you would like—for something like electric drive, which is a risk program, it wouldn't be bad to have a prototyping system where you could put the electric drive in, prototype it without prejudicing an entire class of boats, right?

Admiral FRICK. [Witness nods head.]

Mr. HUNTER. Right?

Admiral FRICK. [Witness nods head.]

Mr. HUNTER. We go for audible answers here.

Admiral FRICK. Yes, sir.

Mr. HUNTER. OK. Tony, do you have something to say about that?

Mr. BATTISTA. The only point I would make is everybody talks about electric drive and how wonderful the potential might be, but in fact there is no money in the budget for it. I mean, any significant amount of money that is going to lead to a capability or a demonstration and a prototype, so it is sort of like one service that always used to say UAV's are great and they would take it right up to 6.4 full-scale development, and then when it was ready for production it would be killed, so, I mean, we are paying lipservice to a lot of these things.

I don't think the admiral is a part of that. I think what is happening is the R&D, ONR [the Office of Naval Research], no money, so a lot of the things you are talking about, they are never going to happen.

Mr. POLMAR. I must raise a question. The admiral just said the difficulty of supporting different design submarines will be too great for us if we build two or three or four different prototypes. I would submit for the record, Mr. Chairman, that right now the U.S. Navy has 10 different submarine designs in active service.

Even after we started drawing down, we have 10 different designs, different types of submarines in service today that we are supporting. Former ballistic missile subs, the *Lafayette* class, which are special operations, the *Memphis* which is a test sub, the NR–1, the *Narwhal*, the *Parchee*, the *Sturgeon* class, *Ohio* class, *Los Angeles* class, improved *Los Angeles* class, and *Dolphin*. It is difficult, but it is done every day by our Navy, every day by the Russian Navy.

Mr. WOOD. Mr. Chairman, it is probably appropriate to inquire as to when technologies will become available and why for attack submarines. We heard Admiral Frick say a few minutes ago that one of the advanced technologies just being inserted in submarines at the present time is reverse osmosis generation of freshwater.

Reverse osmosis was a research topic when I was an undergraduate 35 years ago. Reverse osmosis was a commercial technology in this country in the 1970's. Fifteen years ago, I bought a reverse osmosis unit from Sears Roebuck for my home. It has functioned very satisfactorily for the last 15 years with minimal maintenance and periodic cartridge changes, and yet reverse osmosis is just now called an advanced technology being inserted into our current submarines.

This, I think, explains in a microcosm the entire problem we face with respect to submarine technology and how our current superiority is evolving into inferiority relative to the Russians. We don't invest in tech base. We take a very conservative approach to inserting technology into our submarines, a very measured and deliberate approach, as a result of which eventually a vigorous foreign program not only overtakes us, but surpasses us. This is at the nub, as I said earlier, of the issues which this committee faces with respect to the New Attack Submarine.

There has been no case offered by the Navy either today or previously as to why we need a new class of submarines now relative to the capabilities and the service life of the existing class of attack submarines. The exclusive case made for the New Attack Submarine is the preservation of the industrial base.

The House bill addresses this not only as satisfactorily as does the Navy program, but better because it yet preserves and maintains and enhances competition for creation of the New Attack Submarine between the two yards—Newport and Electric Boat. The key statement, I think, that was made in this respect is that although the Navy says the New Attack Submarine is a bridge between where we stand at the present time and something else, the other end of the bridge is not identified in the Navy proposal.

This is a pure subsidy to the industrial base without regard as to the future needs of the Nation and the future needs very specifically of the Navy as a servant of the national interest in the first few decades of the coming century. A bridge to where is the question which the committee should keep in front not only of the House, but of the Congress in conference.

Where is the bridge going? And why is it leading to inferiority from a position of superiority today to a position of inferiority in the first decade or two of the next century relative to the Russians? Why is it doing that?

Mr. BATTISTA. Mr. Chairman——

Mr. HUNTER. Admiral Jones, did you have a comment?

Admiral JONES. Yes, sir, I would like to address a couple things. First of all, we have to talk about this military necessity. Secretary Perry and General Shalikashvili have authored a letter to the Congress telling them that this is a military necessity.

Now, it is a military necessity and we need it today, we need it tomorrow, and it has been said by our highest people in DOD. Second, we need to talk about these logistics problems.

Mr. Chairman, there is a difference between worrying about logistics problems between different types of submarines when you are talking about at the system level and when you are talking about at the hull level, the hull, electric hook, and maintenance level. We do it today, just as has been stated, but it ain't fun and it costs a lot of money.

We are spending a lot of time right now trying to standardize things so it won't cost us a lot of money, and we would like not to be there. Even though we are doing it, it is costing money and it will cost a lot in life cycle costs to do it some more. We know how to do system life cycle costs and upgrades, but if you are talking about the whole hull, you have got a new problem on your hands, and you are going to cost a lot of money over the life of the ship.

Mr. HUNTER. But what Mr. Polmar talked about with the 10 different configurations of submarines you are currently operating, those are different hulls, aren't they?

Admiral JONES. Yes, sir, but that doesn't mean we like it. I mean we are there because we are there.

Mr. HUNTER. It is a tough world, I understand.

Admiral JONES. Yes, sir.

Mr. HUNTER. But I think he made an excellent point to the effect when you have 10 different types, saying you don't want to take on a few prototypes because it is difficult to handle these different designs is a little bit of an overstatement. We are operating 13 right now and it is status quo.

Admiral JONES. We are operating at a time right now of grave fiscal constraint and we are trying to do this right.

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Mr. HUNTER. Let me ask you one last question. We have got to break. First, I want to charge our panel as the Speaker charged you last night to become intimately acquainted with NAS, at the Navy's invitation, and I would like you to take on that undertaking as quickly as possible.

I see Dr. Foster has gone, but he has just finished heading up the Defense Science Board summer studies. I think he is going to be back here a couple times a week, but if you gentlemen, Dr. Wood and Tony and Norman and Ron, we need you to undertake and Admirals Frick and Jones to undertake a briefing program as quickly as possible. Can we get that going very quickly?

Admiral FRICK. Yes, sir. The first thing I propose is we will get together and lay out a plan and then go execute it.

Mr. HUNTER. OK, excellent, we appreciate that. In fact, we better break because I think we have got a get-to-know-you meeting of the conference, the House-Senate conference here momentarily, and our position with respect to the Senate is if they had only brought some additional money, we would go for all the widgets that they want, so our new rule is whoever brings the money gets the additional equipment. I am sure they will love that.

But thank you for being with us today. I want to thank our panel members for the time you have invested in all of this great volunteer effort, very important to the country, and I think the serious questions have been raised, but I think also that it is clear that this prototyping would not prejudice the Navy in the least.

In fact, Admiral Frick, if you had Electric Boat proceeding with the new attack, this first 98 boat, you call a New Attack Submarine, it wouldn't have any problem with Newport News keeping their hand in and pursuing some new technologies and, who knows, some of them might pan out. That wouldn't prejudice the Navy's operation, would it?

Admiral FRICK. It is merely a—it is an issue of dollars.

Mr. HUNTER. But if we provided the money for it, you wouldn't care if we did it, would you?

Admiral FRICK. As we said, right now I support the President's budget, but you have the option of doing other things. It is not often that we have turned back money, but it really is a matter of dollars and doing execution, and we have been on this path now for three-and-a-half years to do the cost-effective thing I was charged with doing. This is not, in my mind, cost-effective, so I have no——

Mr. HUNTER. Your plan doesn't have Newport News doing anything, so if they are doing some prototyping, while you are proceeding apace with the 98 boat, that shouldn't bother you any, should it?

Admiral FRICK. Only when it comes to the point of the execution of the total ship program, if it starts increasing costs. That is the issue I have. It is the execution of it since I am charged with doing that.

Mr. HUNTER. OK, thank you. Any last comments before we break?

Mr. BATTISTA. I just wanted to say, Mr. Chairman, you got four civilians here. We don't have to go to war, they do, and I appreciate their position. I am often amused by this President's budget comment, though.

I would wonder how President Bill Clinton would feel about open architecture on the NAS if we were to call and ask, you know. We put this stuff in the President's budget and then we use it to say, well, we are sort of constrained. But they are under budget constraints.

I fully appreciate the situation they are in and their position. We have an honest difference of opinion on how to get things done, but I think you will find unanimity of opinion that everybody wants the best for the fleet, and cost-effective to me is a moot point when you are talking about submarine survivability, and I really think that there is a position, and, frankly, I think it is the committee's position that accommodates everybody's concern.

They get a start on their boat, we get the prototypes, and no one has a financial interest in this at this table, and what ultimately happens is I think we provide the insurance for the best submarine for the future. I still say you have a very commendable position.

Mr. HUNTER. Thank you. Why don't we get into our briefing on NAS as fast as possible, and we appreciate the Navy accommodating that request, so gentlemen, thank you, thanks for bearing with us. We have got a lot of work ahead of us. The subcommittee is adjourned.

[Whereupon, at 2:05 p.m., the subcommittee was adjourned.]

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